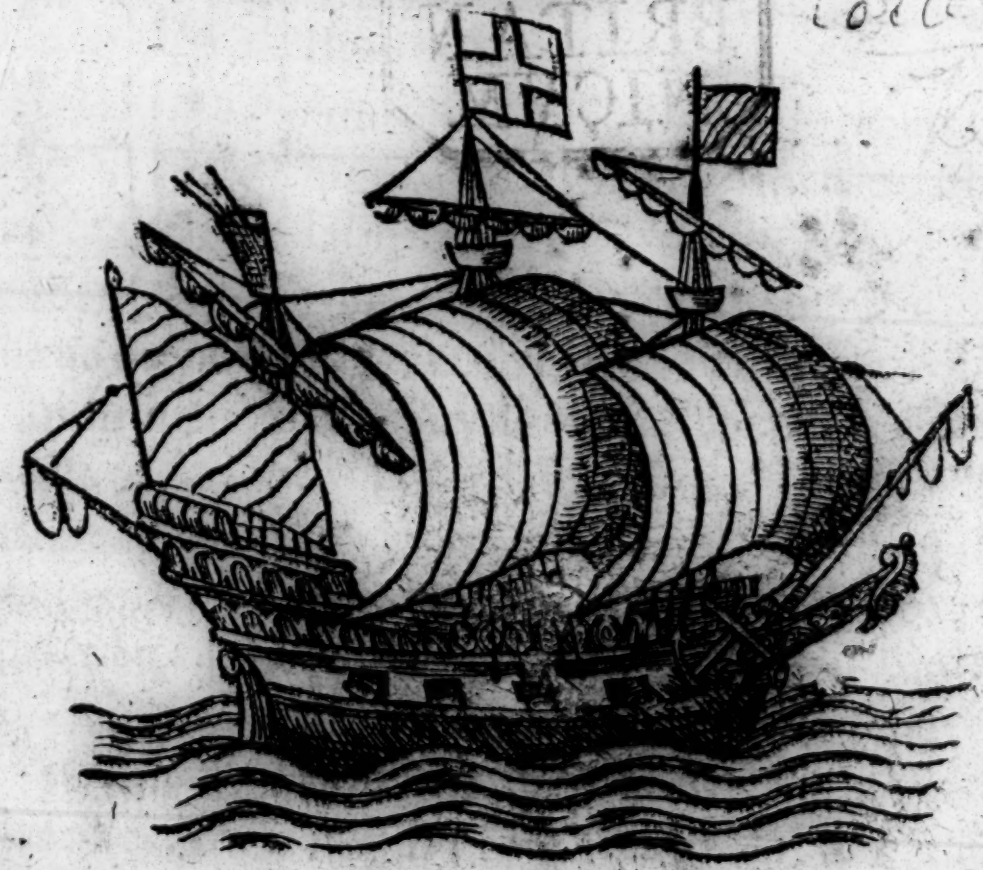
THE ARTE OF NAVIGATION.

533. 1 20

First written in the Spaniſh tongue by that Excellent Mariner and Mathematician of theſe times, MARTINE CVRTIS.

From thence Tranſlated into Engliſh by *Richard Eden*: And now newly Corrected and inlarged, with many neceſſarie Tables, Rules, and Inſtructions, for the more eaſie attaining to the knowledge of Navigation:

By *John Tapp*.



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MVSEVM
BRITAN
NICVM

TO THE RIGHT WORshipfull, Sir VVILLIAM WADE *Knight, Lieftenant for the Kings* moſt Excellent Maieſty, of his Highneſſe *Tower of* LONDON.

IT is no ſtrange thing, Right Worſhipfull, that time the common conſumer of Antiquity, had welnigh worne out the memorable labours of the firſt worthy Author of this worke, which would no doubt haue beene vtterly raked vp in the embers of obliuiouſneſſe, had it any longer ſlept vnder the vaile of obſcurity. A matter ſoone effected in this cankered decaying age, where the moſt popular part are giuen eyther to glory in their own actions, or elſe to depraue others of that praiſe which rightly doth belong vnto them, I ſpeake not this as condemning the multiplicity of bookes extant in this kind; for the Art of Nauigation being ſo excellent to bee practiſed, and the practiſe ſo commodious to all ſortes of

people, there cannot be too much written for the explaning thereof, nor inough ſaid in the commendation of it, the onely thing of which wee are to bee taxed, being, that thoſe worthy Authors, whoſe auntient workes by their painefull labours, haue made plaine pathes, to direct our vnderſtanding, to the knowledge of theſe and many other worthy artes and ſciences, are not ſtill reuiued by their following Diſciples, who haue gained knowledge by their painefull endeauors, who ſhould continue their memory to enſuing poſterity, among which that haue ſucked ſome ſweetnes from the induſtrious labours of former authors, though leaſt able of many, yet to auoide that ſcandalous reproach of Ingratuity: I thought it not amiſſe to enter into a renew of my firſt Tutor into my marine practiſes, who though his principles & grounds both of Philoſophy, Aſtronomy, and Nauigation, cannot but be held authenticall, and might very well paſſe without contradiction, yet Tables being for the moſt part temporary, cannot but in time finiſh their Period, and the whole tract being now brought to a more neare exactnes, then in thoſe dayes it could be, I endeauoured my ſelfe by my beſt meanes to accommodate

date and make it fitte for the profitable practise of the studious learners of Nauigation in these times, and to adorne it with such Tables, rules and instructions, as I thought fittest for the meanest capacities, which being finished and ready to passe abroade into the censuring world, where many of *Momus* Disciples are busily prying where they may catch any occasion to cauell, and albeit I might say to some of them, as *Apelles* did to the Carper at his portraict, yet considering that the author himselfe dared to craue the protection of an Emperour, and the Translator of a worshipfull society, as both fearing the censuring of such Zoylists, I not thinking my selfe more free from the taxation of contumelious spirits, then any of the former, haue presumed to shrowde both the first authors works with my latter additions vnder your Worships patronage, well thinking with my selfe, that hee that is so well addicted to the common good of the Republike, will not deny the protection of that thing, which may any way tend to the profite of the comon-weale in generall. The cause mouing me to dedicate the same to your Worship, being a subiect pertaining to nauigation, is the euident proof of your

worſhips good minde thereto, in that you are well knowne to be ſo great a furtherer of that Honourable action of *Virginea*, which may by Gods grace in after times, proue not onely a direct path to perfection in Nauigation, but ſo commodious to the Republique, that after ages ſhall haue reaſon to bleſſe the memory of thoſe worthy perſonages, whoſe great aduentures, and paineſull endeauours haue purchaſed a ſecond common wealth of profite and pleaſure to inſuing poſterity, and a kingdome to themſelues in endleſſe felicity, which wiſhing the beſt thereof to you, and yours, I reſt,

Denoted to your worſhips ſeruice,

IOHN TAPP.

To the Reader.

COurteous and friendly Readers, you haue here presented vnto your view, the Art of Nauigation, being the gathering and practise of Martin Curtes, a Spaniard, of whose dexterity and perfection in Marine causes, the worke it selfe is a sufficient witnes, for that there is no Booke extant in the English tongue, that in so briefe and easie a method, doth discouer so many and rare secrets, both of Philosophy, Astronomy, Cosmography, and generally, whatsoeuer doth belong to good and sure Nauigation: but because it hath bene so often Imprinted, many faults haue crept into it, through want of ouersceing and good heedtaking, which if they should proceed without correction, it would not onely be a disgrace vnto the Art (which of it selfe is most commendable) and a discredite vnto the Author, which is most worthy of commendations, but also it would be a double damage vnto those which should put it in practise, for that some young Students not being exercised in the practise of the same, and finding some error therein, might be discouraged to proceed to the knowledge of this most excellent Art.

Therefore for the profite and furtherance of all Sea-faring men, to whome I wish as well as to my selfe. I haue vndertaken to ouerlooke the same, and (according to my small knowledge in that Art) corrected the faults, which were gotten thereinto: and besides, knowing how necessary it would be to haue a Table of the declination of the Sunne: I haue truly calculated one, and added it hereunto with diuers such Tables, Rules and Collections, which I thought most needfull in this matter, and profitable for thy practise: of al which, if you receiue profit, the Author is worthily praysed, and I fully satisfied: therefore committing the worke to your study, and my selfe to your fauourable censure, I take my leaue. Vale.

IOHN TAPP.

How to vſe the next table *following*.

IF you deſire to finde in what ſigne of the Zodiacke the ☾ is at any time, firſt reſort to the Kalender, and in the laſt Collume of the moneth vnder the Caracter ☾ of the Moone, directly againſt the day of the moneth, you ſhall finde one of the 24. letters: which bearing in memory, looke the Prime in the page next before, then finding the ſame Prime in the head of this table, and deſcending by the ſaid colume of the Prime, till you finde the letter, which you beare in memory, and right againſt the ſame letter in the outmoſt collume, towards the left hand is the name of the ſigne, which the ☾ then poſſeſſeth: Example, againſt the firſt of April, I find the letter K. and the Prime by the former rule, 1. then going downward vnder the title 1. which I find in the head of the table, till I come to the letter K. againſt the ſame is Virgo the deſired ſigne.

A Table wherein is shewed at all times, what signe the Moone shall be in, by the Prime, and helpe of the letters, in the last Colume of the Kalender, as by the former Example is shewed.

The Prime	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Aries.	y	n	c	v	l	ſt	ſ	b	ʒ	p	e	u	m	a	s	i	ę	q	ſ
Aries.	ʒ	o	d	u	m	a	s	i	ę	q	ſ	r	n	b	t	k	ſt	r	g
Aries.	ę	p	e	r	n	b	t	k	ſt	r	g	y	o	c	v	l	a	ſ	b
Taurus.	ſt	q	ſ	y	o	c	v	l	a	ſ	b	ʒ	p	d	u	m	b	s	i
Taurus.	a	r	g	ʒ	p	d	u	m	b	s	i	ę	q	e	r	n	c	t	k
Gemini.	b	ſ	b	ę	q	e	r	n	c	t	k	ſt	r	ſ	y	o	d	v	l
Gemini.	c	s	i	ſt	r	ſ	y	o	d	v	l	a	ſ	g	ʒ	p	e	u	m
Cancer.	d	t	k	a	ſ	g	ʒ	p	e	u	m	b	s	b	ę	q	i	r	n
Cancer.	e	v	l	b	s	b	ę	q	i	r	n	c	t	i	ſt	r	g	y	o
Leo.	ſ	u	m	c	t	i	ſt	r	g	y	s	o	v	k	a	ſ	v	ʒ	p
Leo.	g	r	n	d	v	k	a	ſ	b	ʒ	p	e	u	l	b	s	i	ę	q
Leo.	b	y	o	e	u	l	b	s	i	o	q	ſ	r	n	c	t	k	ſt	r
Virgo.	ſt	ʒ	p	ſ	r	m	c	t	k	ſt	r	g	y	n	d	v	l	a	ſ
Virgo.	k	ę	q	g	y	n	d	v	l	a	ſ	b	ʒ	o	e	u	m	b	s
Libra.	l	ſt	r	b	ʒ	o	e	u	m	b	s	i	ę	p	ſ	r	n	c	t
Libra.	m	a	ſ	i	ę	p	ſ	r	n	c	t	k	ſt	q	g	y	o	d	b
Scorpio.	n	b	s	k	ſt	q	g	y	o	d	v	l	a	r	b	ʒ	p	ę	u
Scorpio.	o	c	t	l	a	r	b	ʒ	p	e	u	m	b	ſ	i	ę	q	ſ	r
Sagitarius	p	d	v	m	b	ſ	i	ę	q	ſ	r	n	c	s	k	ſt	r	g	y
Sagitarius	q	e	u	n	c	s	k	ſt	r	g	y	o	d	t	l	a	ſ	b	ʒ
Sagitarius	r	ſ	r	o	d	t	l	a	ſ	b	ʒ	p	e	v	m	b	s	i	ę
Capricorn	ſ	g	y	p	e	v	m	b	s	i	ę	q	l	u	n	c	t	k	ſt
Capricorn	s	b	ʒ	q	ſ	u	n	c	t	k	ſt	r	g	r	o	d	v	l	a
Aquarius.	t	i	ę	r	g	r	o	d	v	l	a	ſ	b	y	p	e	u	m	b
Aquarius.	v	k	ſt	ſ	b	y	p	e	u	m	b	s	i	ʒ	q	ſ	r	n	c
Pisces.	u	l	a	s	i	ʒ	q	ſ	r	n	c	t	k	ę	r	g	p	q	d
Pisces.	r	m	b	t	k	ę	r	g	y	o	d	v	l	ſt	ſ	b	ʒ	p	e
Pistes.	y	n	c	v	l	ſt	ſ	b	ʒ	p	e	u	m	a	s	i	ę	q	ſ

5

Hereafter followeth a moſt excellent, neceſſary and compendious Kalender ſhewing the Prime, Epact, Dominicall Letter, Leape yeares, and Moueable Feaſts for twenty foure yeares.

Yeare of our Lord.	Prime.	Epact.	Sunday Letter.		First Sunday in Lent.	Easter day.	Aſcent day.	Whitſunday.	Trinity Sunday.
1609	14	4	A		March 5	April 16	May 25	June 4	June 11
1610	15	15	G		Febr. 25	8	17	May 27	3
1611	16	26	F		10	Mar. 24	2	12	May 19
1612	17	7	E	D	March 1	April 12	21	31	June 7
1613	18	18	C		Febr. 21	4	13	23	May 30
1614	19	29	B		Marc. 13	24	June 2	12	June 19
1615	1	11	A		Febr. 26	9	May 18	28	4
1616	2	22	G	F	18	Mar. 31	9	19	May 26
1617	3	3	E		March 9	Apri. 20	29	June 8	June 15
618	4	14	D		Febr. 22	5	14	May 24	May 31
1619	5	5	C		14	Mar. 28	6	16	23
1620	6	6	B	A	March 5	Apri. 16	25	June 4	June 11
1621	7	7	G		Febr. 18	April 1	10	May 20	May 27
1622	8		F		March 10	21	30	June 9	June 16
1623	9		E		12	13	22	1	8
1624	10	20	D	C	Febr. 15	Mar. 28	6	May 16	May 23
1625	11	1	B		March 6	Apri. 17	26	June 5	June 12
1626	12	12	A		Febr. 26	9	18	May 28	4
1627	13	23	G		Marc. 11	Mar. 25	3	13	May 20
1628	14	4	F	E	2	Apri. 13	22	June 1	June 8
1629	15	1	D		Febr. 22	5	14	May 24	May 31
1630	16	26	C		9	Mar. 23	May 1	11	18
1631	17	7	B		27	Apri. 10	19	29	June 5
1632	18	18	A	G	18	1	10	20	May 27

Dayes.		Ianuarie.	Length of the dayes.	☾	
1	a	New yeres day	7	52	a
2	b	Octa Stephen	7	55	b
3	c	Octa. John	7	58	c
4	d	Octa. Innocent	8	0	d
5	e	Depo. of Edw.	8	3	e
6	f	Twelfth day	8	6	f
7	g	Felix and Janu.	8	8	g
8	A	Lucian Priest.	8	11	h
9	b	Joyce Virgin	8	14	i
10	c		8	16	k
11	d	Sol in Aquarius	8	18	l
12	e	Atlas.	8	20	m
13	f	Hilarie Bish.	8	24	n
14	g	Felicia.	8	27	o
15	A	Maurice	8	30	p
16	b	Marcell	8	33	q
17	c	Depo. of Ant	8	36	r
18	d	Prisca Virgin	8	40	s
19	e	Wolstane bish.	8	43	t
20	f	Fabian and Seb	8	46	v
21	g	Agnes Virgin.	8	50	u
22	A	Vincent Mart.	8	53	x
23	b	Timoth.	9	56	y
24	c	Emerice.	9	0	z
25	d	Con. of Paul.	9	4	&
26	e	Polycarp Mar.	9	6	A
27	f	Chrisost. doctor	9	10	B
28	g	Theodor priest.	9	14	C
29	A	Valerie bishop	9	18	D
30	b	Bateld Queene	9	22	E
31	c	Saturn & Vice.	9	26	F

Dayes.		Februarie.	Length of the day:	☾	
1	d	Fast.	9 30	c	f
2	e	Purifi. of Mary	9 32		g
3	f	Blase Martyr.	9 36		h
4	g	Gilbert confes.	9 40		i
5	A	Agathe virgine	9 44		k
6	b	Dorothe virgine	9 49		l
7	c	Angulle.	9 52		m
8	d	Sallamon:	9 56		n
9	e	Sol in Pisces.	10 0		o
10	f	Scollastica	10 4		p
11	g	Sother Bishopp	10 8		q
12	A	Eufrase virgine.	10 10		r
13	b		10 14		s
14	c	Valentine,	10 18		t
15	d		10 22		v
16	e	Julian virgine.	10 26		u
17	f	Germaine.	10 30		x
18	g	Hugh Bishoppe	10 34		y
19	A	Simeon.	10 38		z
20	b	Wilfred.	10 42		&
21	c	Kyrir Martyrs.	10 46		A
22	d	Peters chaires.	10 50		B
23	e	Fast	10 54		C
24	f	Mathie Apost.	10 58		D
25	g	Innent. Paul	11 2		E
26	A	Nestor,	11 7		F
27	b	Alexander.	11 12		G
28	c	Augustine.	11 16		H

Dayes.		March.	Length of the dayes.		☾	Dayes.		April.	Length of the day:		☾
1	d	Dauid.	11	24	f	1	f	Gildard.	13	30	i
2	e	Chadde	11	28	g	2	g	Marie Egypt.	13	34	l
3	f	Maurice.	11	32	h		h	Richard Bish.	13	38	m
4	g	Adrian.	11	36	i	4	c	Ambrose.	13	42	n
5	A	Focas and Euse	11	40	k	5	d	Vincent.	13	46	o
6	b	Viet & Venin.	11	44	l	6	e	Sextus.	13	50	p
7	c	Perpetue.	11	48	m	7	f	Euphemy.	13	52	q
8	d	Depo of Felix	11	52	n	8	g	Dionisius.	13	56	r
9	e	Forty Martyrs.	11	56	o	9	A	Perpetuus.	14	0	s
10	f	Agapit.	12	0	p	10	b	Apolinia.	14	2	s
11	g	Sol in Aries.	12	4	q	11	c	Sol in Taurus.	14	4	t
12	A	Gregorie bish	12	8	r	12	d	Sother.	14	8	v
13	b	Theodor.	12	12	s	13	e	Marcus.	14	12	u
14	c	Candide.	12	16	s	14	f	Liburtie.	14	16	x
15	d	Longine.	12	20	t	15	g	Osmond.	14	20	y
16	e	Hilla. & Ionase	12	24	v	16	A	Isidorie.	14	24	z
17	f	Gertude.	12	28	u	17	b	Anisette.	14	28	ę
18	g	Edward king	12	32	x	18	c	Eluthertus.	14	32	ſ
19	A	Jose. Mathus.	12	36	y	19	d	Alphage.	14	34	a
20	b	Cuthbert.	12	40	z	20	e	Victor.	14	38	b
21	c	Benedict.	12	44	x	21	f	Simeon.	14	42	c
22	d	Afrodose.	12	48	ſ	22	g	Sother.	14	46	d
23	e	Theodore.	12	54	a	23	A	George Mart.	14	50	e
24	f	Fast.	12	58	b	24	b	Wilfride.	14	54	f
25	g	Anun. of Mary	13	2	c	25	c	Mark. Euange.	14	56	g
26	A	Castor Martyr	13	9	d	26	d	Clete.	15	0	h
27	b	Merciany.	13	10	e	27	e	Anastatius.	15	4	i
28	c	Rupert.	13	14	f	28	f	Vitalis.	15	8	k
29	d	Victorine.	13	18	g	29	g	Peter of Pa.	15	10	l
30	e	Quirine.	13	22	h	30	A	Dep. of Erken.	15	14	m
31	f	Adelme.	13	26	i						

Dayes.		May.	Length of the dayes.		C
1	b	Philip & Iacob	15	18	n
2	c	Athanasius.	15	20	o
3	d	Inu. of the crosse	15	24	p
4	e	Christopher.	15	28	q
5	f	Godard.	15	30	r
6	g	Iohn port. lat.	15	32	s
7	A	Iohn of Beuer	15	34	t
8	b	Aper. of Micha.	15	36	u
9	c	Transl. of Mic	15	40	v
10	d	Gordian,	15	42	u
11	e	Anthony.	15	44	x
12	f	Sol in Gemini.	15	46	y
13	g	Seruatus,	15	49	z
14	A	Boniface mart.	15	52	&
15	b	Isidore.	15	54	A
16	c	Victor. mart	15	57	a
17	d	Dunstane	16	0	b
18	e	Bernardine	16	2	c
19	f	Aquilla.	16	5	d
20	g	Dunstone.	15	8	e
21	A	Barnardine	16	10	f
22	b	Helena queene	16	12	g
23	c	Desiderij.	16	14	h
24	d	Serule.	16	15	i
25	e	Urbane.	16	16	k
26	f	Adelme confess.	16	18	l
27	g	Bede Priest.	16	19	m
28	A	Germaine.	16	20	n
29	b	Tozons	16	21	o
30	c	Felix	16	22	p
31	d	Petronil.	16	23	q

Dayes.		June.	Length of the dayes.		C
1	e	Nichomede.	16	24	r
2	f	Marcell.	16	25	s
3	g	Erasmus.	16	26	t
4	A	Petrocus.	16	27	u
5	b	Boniface.	16	28	v
6	c	Melon	16	29	u
7	d	Paul Bishop	16	30	x
8	e	Transl of Edm.	16	30	y
9	f	Ianua. confess.	16	30	z
10	g	Tran. of Wolst.	16	30	&
11	A	Barnard apo.	16	30	A
12	b	Sol in Cancer.	16	30	a
13	c	Anthonie.	16	30	b
14	d	Basilides.	16	30	c
15	e	Vice and Mode.	16	29	d
16	f	Tran. of Rich.	16	28	e
17	g	Botolph	16	28	f
18	A	Mar. & Marcel.	16	27	g
19	b	Gernasius.	16	27	h
20	c	Tran. of Edw.	16	26	i
21	d	Walburge.	16	25	k
22	e	Albone.	16	24	l
23	f	Fast	16	23	m
24	g	Iohn Baptist.	16	22	n
25	A	Amandi.	16	20	o
26	b	John & Paul	16	19	p
27	c	Crescence	16	18	q
28	d	Fast.	16	16	r
29	e	Peter & Paul	16	15	s
30	f	Com. of Paul.	16	14	

Dayes.			Iuly.	Length of the daye.		☽	Dayes.			August	Length of the day:		☽
1	g	A	Octa of Iohn.	16	12	t	1	c		Lamas.	14	46	p
2	A	b	Visite of Mary.	16	10	v	2	d		Steph̃en	14	42	q
3	b	c	Tran of Thom.	16	8	u	3	e		Inuent. Sept.	14	38	r
4	c	d	Tran of Mart.	16	5	y	4	f		Iustine,	14	34	s
5	d	e	CCC virgins	16	3	z	5	g		Festũ Nunis	14	32	a
6	e	f	Martalis	16	2	A	6	A		Trãsfi. of Chri.	14	28	b
7	f	g	Zenane mart.	16	0	B	7	b		Feast of Iesus	14	24	c
8	g	A	Depo. of Grem.	15	57	C	8	c		Ciriacke,	14	20	d
9	A	b	Cyril Bish	15	54	d	9	d		Roman Mart.	14	16	e
10	b	c	Dog daies begi	15	52	e	10	e		Laurence mar.	14	12	f
11	c	d	Seuen brethren.	15	49	f	11	f		Cutbert.	14	8	g
12	d	e	Nabor & Felix.	15	46	g	12	g		Clarie,	14	4	h
13	e	f	Sol in Leo.	15	44	A	13	A		Hiplit.	14	0	i
14	f	g	Reuell.	15	42	b	14	b		Sol in Virgo.	13	56	k
15	g	A	Transl. Suite	15	40	c	15	c		Assump. Marie	13	52	l
16	A	b	Transl. Osmõd.	15	37	d	16	d		Roch Mart.	13	50	m
17	b	c	Katharine.	15	34	e	17	e		Octa Laurence.	13	46	n
18	c	d	Arnulfe,	15	30	f	18	f		Leus	13	42	o
19	d	e	Rufian & Iust.	15	28	g	19	g		Barneid.	13	38	p
20	e	f	Margaret	15	24	A	20	A		Dog daies end.	13	34	q
21	f	g	Praxede.	15	20	b	21	b		Priuate.	13	30	r
22	g	A	Mary Magde.	15	18	c	22	c		Timothe.	13	26	s
23	A	b	Apolinaries.	15	14	d	23	d		Fast	13	22	s
24	b	c	Fast	15	10	e	24	e		Barthol. Apo.	13	18	t
25	c	d	Iames Apostle	15	8	f	25	f		Lewes King.	13	14	v
26	d	e	Anne mot. Ma	15	4	g	26	g		Seuerne	13	10	u
27	e	f	Vii. Sleepers,	15	0	A	27	A		Rufine Martyr.	13	8	x
28	f	g	Sampson	14	58	b	28	b		Augustine bish	13	6	y
29	g	A	Martha,	14	56	c	29	c		Iohn beheaded,	13	2	z
30	A	b	Abden & Sen.	14	54	d	30	d		Felix & Audas.	12	58	e
31	b	c	German.	14	50	e	31	e		Cutbert.	12	54	f

Dayes.		September	Length of the dayes.		☾
1	f	Giles.	12	48	s
2	g	Anthony mar.	12	44	v
3	A	Lupus Bishop.	12	40	c
	b	TransCuthb.	12	36	d
4	c	Bertine.	12	32	e
5	d	Eugenius,	12	28	f
6	e	Nati·Eliz. Reg.	12	24	g
7	f	Natiu. of Mary	12	20	h
8	g	Gorgonie.	12	16	i
9	A	Siluius Bish.	12	12	k
10	b	Protec. & Hist.	12	8	l
11	c	Martinian,	12	4	m
12	d	Sol in Libra,	12	0	n
13	e	Holy Crosse,	11	56	o
14	f	Philetus,	11	52	p
15	g	Edith,	11	48	q
16	A	Lambert.	11	44	r
17	b	Vict. and Cor.	11	40	s
18	c	January mar.	11	36	
19	d	Fast	11	32	t
20	e	Mathew Apo.	11	28	v
21	f	Maricius,	11	24	u
22	g	Tecla Virgin.	11	20	x
23	A	Andochius,	11	16	y
24	b	Fermine	11	12	z
25	c	Sipri & Iust.	11	6	ꝛ
26	d	Cosme & Da.	11	2	st
27	e	Eruperius.	10	58	ı
28	f	Michael Arch.	10	54	ꝺ
29	g	Hierome priest,	10	50	c
30					

Dayes,		October	Length of the dayes:		☾
1	A	Remigius.	10	46	d
2	b	Leodegary.	10	42	e
3	c	Candide.	10	38	f
4	d	Fraunces.	10	34	g
5	e	Apoline.	10	30	h
6	f	Faith.	10	26	i
7	g	Martine.	10	22	k
8	A	Pelagius.	10	18	l
9	b	Gercon & Vic.	10	14	m
10	c	Nicasius	10	10	n
11	d	Edward King.	10	8	o
12	e	Adorant.	10	4	p
13	f	Calistes.	10	0	q
14	g	Sol in Scorpio.	9	56	r
15	A	Wolfran.	9	52	s
16	b	Mich. of ye moũt	9	48	s
17	c	Etheldred.	9	44	t
18	d	Luke Euangel.	9	40	v
19	e	Fredeswide.	9	36	u
20	f	Austerbert.	9	32	r
21	g	Xi. M. Virgins	9	28	y
22	A	Mary Salom.	9	26	z
23	b	Romaine.	9	22	ꝛ
24	c	Haglory.	9	18	st
25	d	Crispine.	9	14	a
26	e	Ursula.	9	10	b
27	f	Fast	9	6	c
28	g	Simon & Iude	9	4	d
29	A	Narsisus.	9	0	e
30	b	German.	8	56	f
31	c	Fast.	8	52	g

Dayes.		November	Length of the daye.	☽	Dayes.		December	Length of the day.	☉
1	d	All Saints.	8 50	b i	1	f	Eligius.	7 36	l
2	e	All Soules.	8 46	i	2	g	Libane.	7 35	m
3	f	Wenefride.	8 42	k l	3	A	Dep. Osmond.	7 34	n
4	g	Amantius.	8 40	l	4	b	Barbara.	7 33	o
5	A	Lete Priest.	8 36	m	5	c	Dana.	7 32	p
6	b	Leonard.	8 32	n	6	d	Nicolas bishop.	7 32	q
7	c	Wilbrode.	8 30	o	7	e	Ambrose.	7 31	r
8	d	Foure crowne,	8 26	p	8	f	Conc. of Mary.	7 30	s
9	e	Theodore.	8 24	q	9	g	Ciprian.	7 30	s
10	f	Benet.	8 20	r	10	A	Eulalia.	7 30	t
11	g	Martine Bish	8 18	s	11	b	Damase.	7 30	u
12	A	Paterne.	8 16	s	12	c	Sol in Scorpio.	7 30	u
13	b	Sol in Sagit.	8 14	t	13	d	Luce Virgin.	7 30	x
14	c	Transl. Erken	8 11	v	14	e	Nicasius Bish	7 30	y
15	d	Wachute.	8 8	u	15	f	Valerius.	7 31	z
16	e	Dep. Edmond.	8 6	x	16	g	Lazarus mort.	7 32	z
17	f	In it Reg. Eliz.	8 3	y	17	A	O sapientia.	7 32	A
18	g	Octa Mary.	8 0	z	18	b	Gracian.	7 33	a
19	A	Eliza Martyr.	7 58	A	19	c	Venetia Virgi.	7 34	b
20	b	Edmond King	7 55	A	20	d	Fast	7 35	c
21	c	Presen. Mary	7 52	a	21	e	Thomas Apost	7 36	d
22	d	Cecili Virgin.	7 50	b	22	f	xxx Martyrs.	7 37	e
23	e	Clement,	7 47	c	23	g	Victor.	7 38	f
24	f	Grisogon.	7 45	d	24	A	Fast	7 40	g
25	g	Katharine.	7 44	e	25	b	Christmas day	7 41	h
26	A	Line.	7 42	f	26	c	Stephen martir	7 42	i
27	b	Agricola.	7 41	g	27	d	Iohn Euangel.	7 44	k
28	c	Rufus martyr.	7 40	b	28	e	Innocents day	7 45	l
29	d	Satu. ¶ Fast.	7 38	i	29	f		7 46	m
30	e	Andrew Apo.	7 37	k	30	g	Trā of James	7 48	n
					31	A	Siluester.	7 50	o

THE FIRST PART OF this worke, which entreateth of *the compoſition of the world, and of* the vniuerſall principles for *the Art of Nauigation.*

CHAP. I.

Of the generall diſtinction of *Creatures.*

THE infinite God, the beginning, and cauſe of the whole vniuerſall, created three orders of creatures, differing in kind: that is to ſay, Corporall, as the Elements: Spirituall, as Angels: and compounded of theſe two, as Man: The corporall nature is diuided into bright and ſhining bodies, as the Starrs: or into darke and thicke bodies, as Earth and Mettals: either into Diaphane or tranſparent bodies, as aire and water. Of theſe creatures (as ſaith S. Gregorie) ſome haue only beeing, as Stones: ſome liue, as Trees: and other haue ſenſe, as Beaſts: other vnderſtanding, as Man: who in holy Scripture is called all Creatures, according to the ſaying of Chriſt to his Diſciples, where he ſaith, Goe and preach the Goſpel to all creatures. And therefore not without good cauſe was Man called of the Greeke Philoſophers, Microcoſmos, (that is)

the lesse World. In the which we contemplate things of no lesse admiration, than in the great World. The similitude betweene them both, is, that euen as the great world, and the whole Globe or Spheare thereof, is moued by the voluntarie motion of an intellectiue substance, or an Angell: euen so is this. For (as Aristotle writeth) Whatsoeuer is mooued, is mooued by vertue of another: As, Man is moued by the internall or inward forme that is within him, (that is to say) by the intellectiue soule that is proper vnto him. In like manner, in the great world are found diuers moueable things; All which, are reduced to one immoueable mouer. So in man are found many things moued by diuers motions, which are all referred to his intellectiue soule. The great world containeth the creatures within it selfe, and consequently is all really, as hauing nothing without it. Euen so, man by knowledge is all, and knoweth all things, and nothing naturally is hid from him, or vnknowne to him. Againe, in this lesse humane world are two motions, Intellectiue, and Sensual. Then consequently the great world hath two locall motions; the one, wherewith the first moueable is moued, and draweth with it all the other Spheres from the East to the West, and is called Rationall mouing. The second, is the mouing of the other Spheres, from the West into the East; and is called Irrationall mouing. But now leauing to speake of the lesse world, we will proceed to speake further of the great.

CHAP. II.
Of the definition of the World.

The world (as saith Isidorus) is heauen and earth, and the other workes of God that are contained therein. It is compounded of things visible, and yet vnsearchable. Moses and Saint Iohn the Euangelist witnesse that it was made by GOD. The Philosophers called it Mundus a mouendo, because it is in continuall mouing, and neuer in rest.

rest. The Grecks called it Cosmos, which signifieth, Faire, or Beautifull, and so named it, because of the marueilous ornament thereof, and diuersitie of elements, with the resplendence or shining of the Sunne, Moone, and Starres. And doubtlesse, nothing may be seene with the corporall eies of man, more beautifull than it is. In so much that the diuine Philosopher Plato affirmed, that eyes were giuen to men to behold the beauty thereof, and to take pleasure in the contemplation of the heauenly bodies and roundnesse of the world, which also for the roundnesse thereof, is called Spherical, because that Sphæra in the Grecke tongue signifieth a round bodie.

CHAP. III.
Of the definition of the Spheare.

THeodosius saith, that the Spheare is a whole and corporall figure, vnder one superficiall: in the middest whereof, is a point or pricke, from the which all right lines drawne directly to the circumference, are equall.

This point or pricke, is called the center of the Spheare: according to Euclide, it is the passage of the circumference of halfe a circle, which is turned round about his Diameter that is fixed, vntill it returne to his owne proper place again, as where it was at the first. By the center of the Spheare passeth the right line, and the extremities or ends thereof, touch in the circumference. And this line (imagined) is called the Axis, or Axeltree of the Sphere, and the ends thereof are called the Poles. Vpon this Axis is the Sphere of the world moued.

CHAP. IIII.
Of the diuision of the world.

IT is to be presupposed, that there is difference betweene Element, and Elementate, and the first, beeing called

quinta Essentia. The Quint Essence, or fift substance, is a body of it selfe, differing from all Elements, and things Elementall, as well in matter as in forme, and no lesse in nature and vertue: and hauing in it selfe no contrarietie, is certainly without corruption. And hereof commeth it, that the Philosophers called the Heauens and Heauenly bodies, the fift substance, or fift essence, by reason of the incorruptibilitie thereof. Element is that, whereof any thing is compounded. It is the first of compositions, and of it selfe is not compounded. Whereby it followeth, that neither the earth, the ayre the water, nor the fire, that are nere vnto vs, or about vs, are pure and simple Elements. For these Elements doe sometimes mingle themselues one with another, and especially where they are neere together, and touch one another. Of these Elements euery part is named by the name of the whole: As euery part of fire, is called fire, and euery part of earth, is called earth, and so of the other. They are called simple bodies in respect of other compound and mixt bodies. They are diuisible into parts of diuers formes; and of the commixtion of them, are made and engendred diuers things of sundry kinds. These foure, (that is to meane, Earth, Ayre, Water, and Fire) although they are named simple, but in respect, as aforesaid, yet are they the Elements (that is to say) beginnings and principles of all other compounds and mixts. A pure Element cannot be seene, forasmuch as that that is pure, lacketh colour; and that that hath no colour is not visible. The Elements (as saith Isidorus) were diuided by the hand of God. The imperiall Heauen was replenished with Angels, the ayre with birdes, the sea with fishes, and the land with men, and other beasts. Elementate, is euery body compounded of the 4. Elements. Not that they are Elements formally, but vertually in mixt bodies. This knowne, we will shew how the world is diuided into two regions: Celestiall, and Elementall. The region Elementall, which is continually subiect to alterations, is diuided into foure Elements: which are, Earth, Water, Ayre,

Ayre, and Fire. These Elements, the Grékes call Ytogia, for the communion and concord that they haue betwéen themselues. The heauenly or Aetheriall region (called Quinta Essentia) compasseth and containeth the Elementall world within it.

CHAP. V.

Of the number, order, and propertie of the Elements and Heauens.

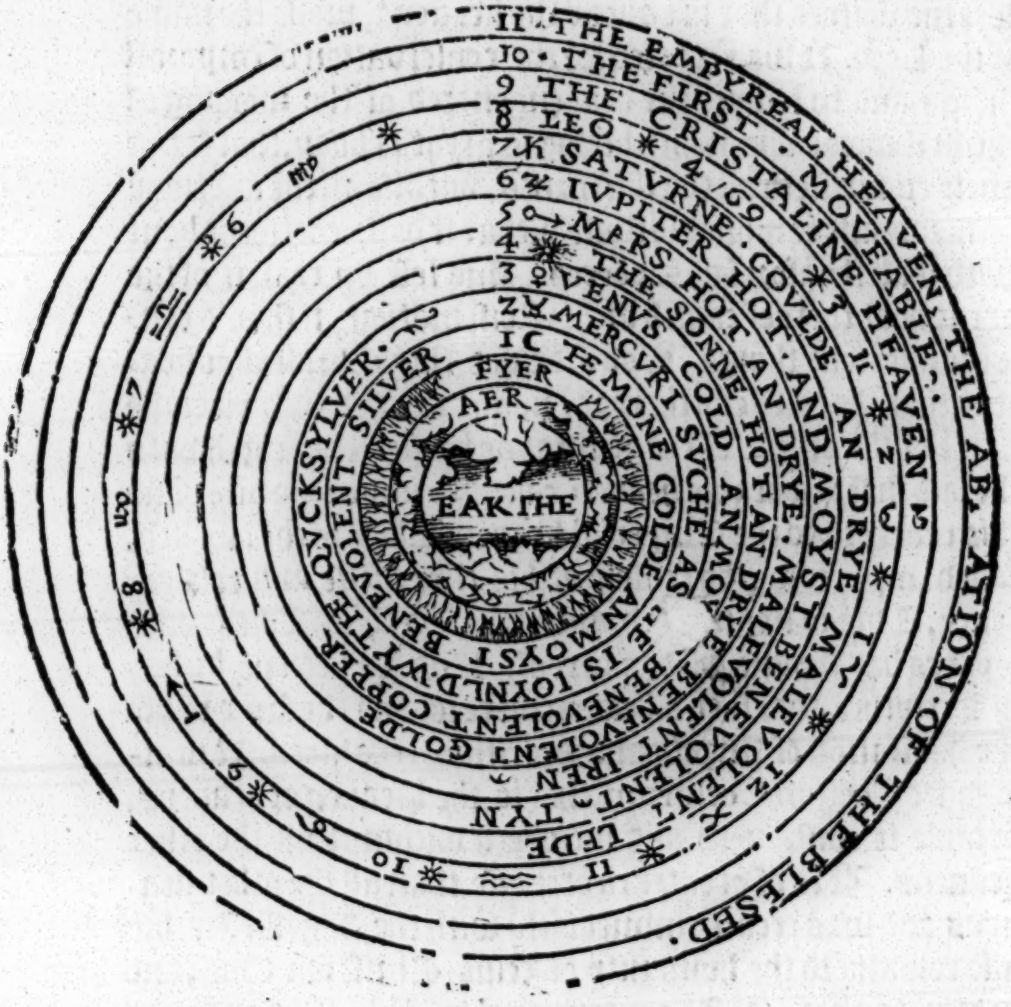
THe Earth (after the Philosopher) is a pricke or point in the middest, called the center, to the which they assigne the lowest place. Next vnto the earth, and about it, the water occupieth the second place, and the ayre the third. The fire is higher than any of the other Elements. And it is to vnderstand, that the water hath two superficials: One, which is called concaue, or hollow; the other, conuex or embowing. You may compare the inward part of the concaue to a dish or a bowle, whose outward part is called conuexe. As touching the concaue, the water compasseth about the earth, leauing discouered that part that serueth for the respiration and life of man, and other beasts. As concerning which, some thinke that the Ocean sea is higher than the earth, and aske the question, why the sea couereth not the whole earth, and why the earth is not sunke in the water? To this it may be a sufficient answer, that it hath so pleased the will of God, according to the saying of the prophet Dauid: Terminum posuisti, quem non transgredietur, neq; conuertetur operire terram: That is, Thou hast appointed limits, which it shall not passe, neither shall it returne to couer the earth. Beside the will of God, which is the chiefe and efficient cause thereof, we say that nature faileth not in her necessaries. For shee sometime admitteth a little inconuenience, to auoyd a greater euill: as when heauy things, which naturally should descend, doe not onely not descend, but rise vp: And as also sometime it chanceth that fire descen-

deth, and water ariseth to fill the voyd or emptie places, lest any where should be found voyd or emptie, which Nature so greatly abhorreth. To this purpose, nature foreseeing the kinds of many things that could not elsewhere liue than on the earth, neither be conserued within the water (as men, & other earthly beasts) determined before to make the earth not perfectly round, contrary to the nature thereof: whereof it followeth, that it is not altogether couered of the water. And as (saith Origen) the earth remaineth discouered of the water, that it might bring forth fruits, trées, & plants. As touching the conuex aforesaid, the water and earth discouered, are contained vnder the concauitie of the ayre, which is diuided into three regions, as the lowest, highest, and middlemost. The lowest is hotte, by reason of the reflection or rebounding of the beames of the Sunne, stricken backe by the earth. The highest also is hotte, by participation of the fire, and neerenesse thereunto. The middle region is cold, as is manifest by the snowe and haile, engendred in the same. The ayre neere vnto the region of the fire, which is pure heate, doth neither burne nor lighten, because it hath no combustible matter, and so hath it power, and not act. It is néere vnto, and reacheth to the circle of the Moone, which compasseth it about. The heauen, or circle of the Moone, is next vnto the heauen of Mercuri: and Mercuri vnto Venus: Venus, vnto the Sunne: the Sunne, to Mars: Mars, to Iupiter: Iupiter, to Saturne, which is next, and reacheth vnto the heauen of the Starres, called the firmament, because that in it are all the Starres (except the planets) firme and fixt, as a knot in a table. The knowledge of the planets was had by seauen sundry motions they haue among themselues, and by their course, not vniforme to that of the Starres of the eight heauen, because that sometimes the planets appeare vnto vs ioyned together, and sometimes diuided. The Chrystaline heauen compasseth about, or containeth within it the heauen of Starres. This Chrystaline heauen, is transparent, and perspicuous, as cleare water or glasse that may

be

be seene through, by reason of the clearenes & pure substance thereof. It is by another name called, the heauen of water, whereof holy Scripture speaketh, saying, Aquæ quæ super cœlos sunt, laudent nomen Domini. That is to say, Let the waters that are aboue the heauens, praise the name of the Lord. It was created for the conseruation of corporall things, and to temper the heat engendred of the moning of the first moueable, which beeing so great of body, that it not onely compasseth all the Elements, but also all the inferiour heauens, and is moued so swiftly, that it daily carrieth about with it all the aforesaid Spheres. And lest by reason of the great heat thereof caused by his swift motion, it should consume inferiour things, God ordained this Christaline heauen, that the coldnesse thereof, might temper the extreame heate of the other. This christaline heauen, reacheth vnto the said first moueable heauen, called Primum mobile. And this reacheth to the Emperial heauen, which is the twelfth, called Imperium, by reason of his clærenesse and resplendence. This is not moued, and is most perfect. The Philosophers had no knowledge hereof. But we beleeue by holy Scripture, that such a heauen there is, and the same to bee the habitation of Angels, and Spirituall creatures. It is also called Cœlum Cœlorum, that is, the Heauen of heauens, because it containeth and includeth within it all the other heauens. It is of greater cleerenesse than all the other heauens, and was created immediatly with the Angels. In this also remaineth the humanity of Jesus Christ our God, and in dignity aboue it. It containeth three holy orders or principalities, called Hierarchies. Whereof the first is called Supercelestiall, and hath in it also three orders, Seraphims, Cherubims, and Thrones. The second is called Celestiall and containeth dominions, principates, and potestates. The third, called Subcelestial, containeth Virtutes, Archangels, and Angels. And to conclude, it hath abundance of all goodnesse and perfect felicitie, with priuation or want of all euill. The heauen also giueth influence of constancie, stedfastnes

and durabilitie to things, against the fluxibilitie and inconstancie of the other heauens: the order whereof, doth appeare in the demonstration following.



CHAP. VI.

Of the immutabilitie, or immobilitie of the Earth.

The Pythagorians and other auncient naturall Philosophers (as saith Aristotle) were of opinion that the Earth did moue, yet not by a right forth motion, but circularly about the middest of one place. The which errour, both

Aristotle

Aristotle himselfe, and the Astronomers do confute, and reproue by euident causes, and manifest demonstrations: For circular motion, is proper to the heauens. And as the earth differeth from them in nature, so likewise in moouing. And although it be so that the earth may naturally moue by certaine of his parts, yet to moue in the whole, and without the circuit of his Sphere, it is impossible, beeing founded and established vpon his owne center, the which of it selfe is naturally immoueable: for as much as in it the reason of all heauines consisteth. Whereas otherwise, euery part that is moued should ascend, contrary to the nature of all heauie things. But there is found nothing heauy that doth not naturally encline directly to the center of the earth, and would actually descend thither, if it had no impediment of some other thing to resist it: and when it toucheth there, or is come thither, would still rest and remaine there. And hereby it followeth, that the earth, being founded vpon his owne center, is not moued. The which thing the prophet Dauid also affirmeth, saying, Fundasti terram super stabilitatem suam (that is) Thou foundest the earth vpon his stabilitie.

CHAP. VII.

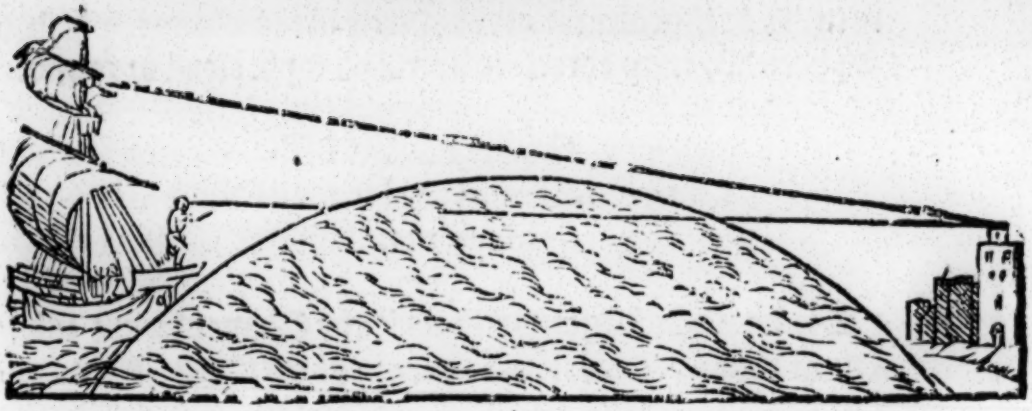
Of the roundnesse of the Earth and Water.

That the Earth is round, it appeareth by manifest euidence: for if it were plaine or flat, the dawning of the day or day spring, should equally and at one time appeare to them in the West, as to them in the East. But we see the contrary, that it appeareth first to them that dwell in the East, and afterward to them in the West. This is proued by the Eclipse of the Moone, which beginning at one instant, they of Hierusalem see it begin at tenne a clocke of the night. And we of London in England, at one a clocke in the morning. It followeth hereby, that to them it lighteneth three houres sooner than vnto vs in England: and this is caused by the roundnesse of the Earth. It is also as well knowne to

be

be round from the pole Artricke, to the pole Antartycke: for by the roundnesse thereof, is caused the equalitie and inequalitie of the dayes and nights. The same is likewise knowne by the raysing of the Pole aboue our Horizon. And that the superficiall part of the earth and water, is all one round and spericall Globe, is manifest by the shadow thereof, beeing a certain darke bodie, reflected from the Earth in the Eclypse of the Mone. For by this, as by plaine demonstration, may we knowe that the earth is round, as may more manifestly appeare by this Figure. It is also proued, that the water is a round body, as is seene by experience. For if you erect a marke vpon the Sea banke of a port, and a Ship depart from that port a certaine space, then standing in the poupe or sterne of the Ship, you shall not see the marke aforesaid: but if you stand in the top of the ship then may you see it. Whereas notwithstanding (if that portion of the bending Arke of the earth did not hinder the sight) you should see it better beeing in the poupe, for as much as it is nearer to the marke, than to the toppe of the Shippe, as by this demonstration following, appeareth.

But



But here some may moue a doubt, saying, that on the earth we may see many mountaines, and consequently many great Valleyes and plaines, with many diuersities of sundry other deepe and vnequall places, by reason whereof, the earth cannot truely be called round. To this I say, that in two manners, the earth is called and vnderstood to bee round: as after one manner, speaking precisely, it is called round, as a Circle or a Sphere, which we call round, because that all right lines drawne from the center thereof to the circumference, are equall: the other roundnesse, is considered without this precisenesse; and is such, as not by all his parts is equally distant from his middest or center, but hath some parts higher, and some lower, yet not in such quantitie as may destroy the roundnes of the whole. As if in a Bowle there were certaine clifts or holes, it should not thereby leaue to be round, although not perfectly or precisely round. And for this cause saith Auerrois, that although both the heauenly bodies and the Elements are of round forme, yet differ they in this, that the heauenly Spheres haue perfect roundnesse, and the elements not. As the earth, by reason of his Mountains and Valleys the Sea by his encreasing, and decreasing: the ayre also for his nærenesse to the fire, and by his contrarietie doth sometime doe, and sometime suffer (that is to say) is sometime actiue, and sometime passiue. So that following the one, it fleeth the other, by reason whereof, it also lacketh perfect roundnesse. But the fire, for as much as it

is

is neare to the concaue of the Circle of the Moone, which is Spherical, may therefore be called Spherical or round.

CHAP. VIII.
Of the motion of the Heauens and Elements.

IT is not to be forgotten, that all the Elements are wholy moueable by locall motion, except the earth. The water is mooued by the motion of the Moone, or tossed by the Windes. The fire (as sayth Aristotle) is moued circularly by the motion of the day, and is drawne of the circles that embrace, or compasse it about: as is manifest by the Cometes, or blasing Starres, and other fiery exhalations, contained and engendred in it: which beeing carried with this motion, conclude, that the fire moueth in like manner. And with this motion is the superiour part of the ayre violently carried about, as the other impressions therein doe shew. The inferiour part is moued by diuers motions (that is to meane) laterally, as by experience wee see, when the winds blow. The Moone with her Heauen or Sphearc, by her proper motion glueth her turne from the West to the East, in xxvii dayes, and vii. howres, with xv. minutes: Venus, Mercurie, and the Sunne, in a yeare, which is the space of three hundred threescore and fiue dayes, with fiue howres, and forty and nine minutes. Mars in two yeares: Iupiter in twelue yeares. Saturne in thirty yeares. The eight heauen, which is the Firmament, or starry Heauen, by his owne proper motion is moued by the ninth Heauen: vpon the beginning of Aries and Libra, and vpon these two pointes accomplisheth his Reuolution in seauen thousand yeeres.

This motion is called Motus trepidationis (that is to say) the trembling motion, or motion of accesse and recesse. The ninth heauen endeth his motion from the west to the east, in forty and nine thousand yeares: And by this motion.

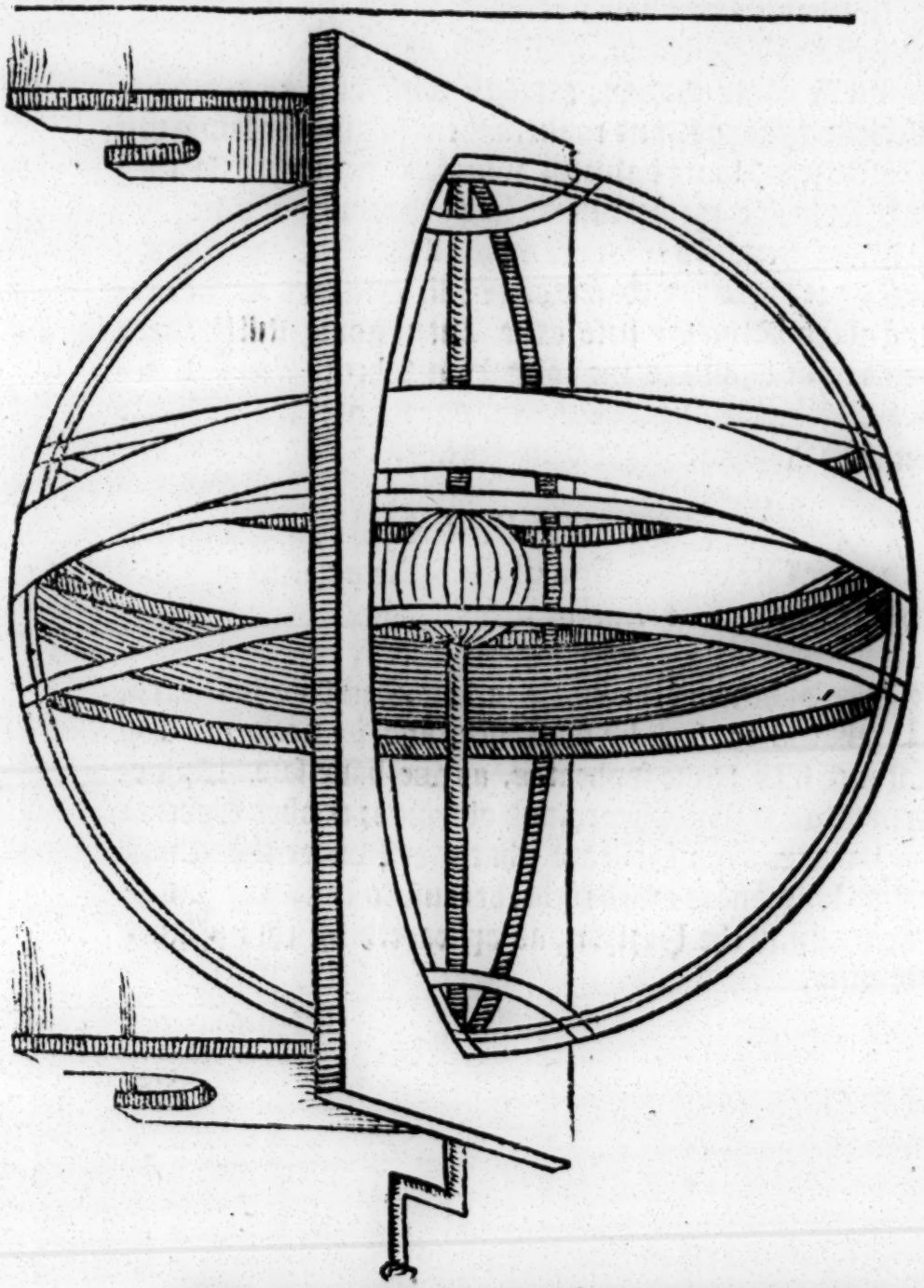
motion moueth the eight heauen. The tenth heauen called Primum Mobile is moued from the East to the West, and in twenty foure howres (which is a naturall day) performeth one Reuolution, and with the mighty force and swiftnesse of his Motion, carrieth with him all the other inferiour heauens, and maketh them to giue the same turn in twenty and foure howres, whereas neuerthelesse they cease not in the meane time to kéepe the course of their own proper motion. As (for example) if an Ant or Pismire should goe about the whéele of a Mill, contrarie to the mouing of the Whéele: before the Ant in going still forward should come againe to the point from whence shee first departed (which is once about, or one turne) the Whéele should in that space make many turnes.

CHAP. IX.

Of the Diuision of the Spheare, into formall Partes.

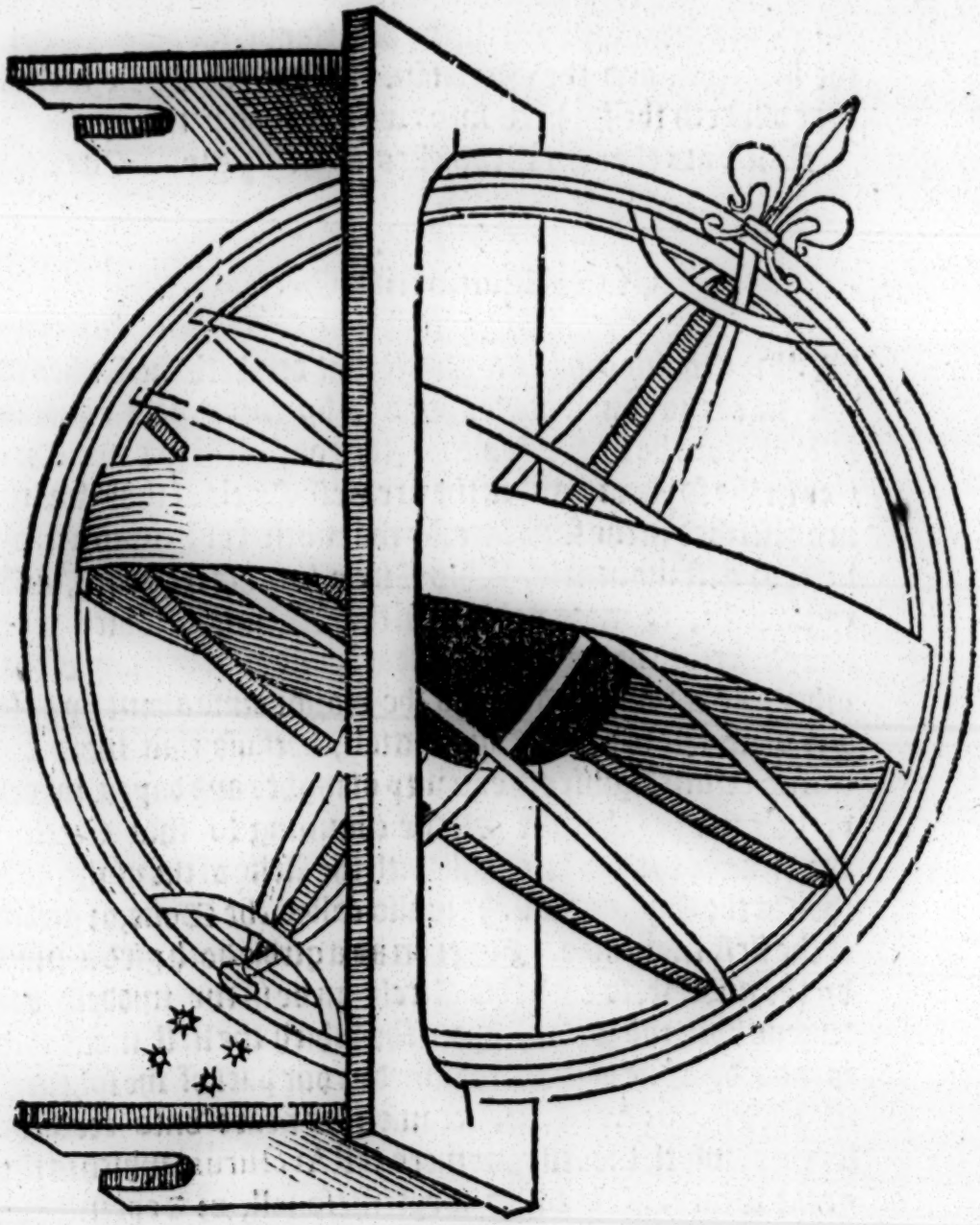
THe Spheare of the world is diuided in two manners, (that is to say) by substance, and by accident. By substance into tenne Spheares, as we haue said. By accident into a right Spheare, and oblique or crooked Sphere: they haue the right Spheare that dwell vnder the Equinoctiall lyne and is called right, because to them the Poles are equally in the Horizon, as appeareth by this Figure following.

The



They haue the oblique Spheare that dwell either on this side or the other side of the Equinoctiall, vnto whome is

is euer one of the Poles aboue the Horizon, and the other vnder it, as appeareth in this Figure.



This Sphere is compounded of ten Circles imagined.

And

And (as saith Iohn de sacro bosco in his Booke of the Sphere) six of them are greater, and foure lesse. The greater Circle, is that which diuideth the Sphere into two equall partes, and hath his Centre with the Center of it. These are the Equinoctiall, the Zodiaque, the two Coluri, the Horizon, and the Meridian. The lesse Circle, is that that diuideth the Sphere into two vnequall parts.

These are the two Tropickes, and two Polar Circles.

CHAP. X.
Of the Equinoctiall Circle.

The Equinoctiall is a Circle that deuideth the Spheare into two equall partes, and is by euery part equallie distant from both the Poles: It is one of the greater Circles in the Spheare, and is the greatest Circle of those which are described in the Spheare, by the motion of Primum mobile, or first moueable. This Circle for his equality, and regularity, is more noble then the Zodiaque, which wee haue described in the eight Spheare, and also then any of the other. It is imagined to gird the world round about by east and west. It is called Equinoctiall, because this word Equinoctium, signifyeth equality of nights and dayes, whereof the cause is, that the Sunne comming to this Circle: the Arke of the day is equall with the Arke of the night, and then is the Equinoctiall. It is also called the Zone, or girdle of the first moueable. For euen as a girdle doth gird a man by the middest, so doth this Circle girde in the middest betweene both the Poles, vpon the which the first moueable is moued. One of these imagined in our part of the speare, is called Polus Arcticus, because it is neare vnto certaine starres, which the Astronomers call Arcturus, which is the great Beare. It is called Septentrionall, or Septentrine, because that round about it are moued the 7. starres which make the lesse Beare, commonly called Bozina (that is) the horne, the starre which is in the tayle of the lesser Beare,

is

is called the North starre, because it is neare vnto the North Pole: the which Pole is a certaine point in the Firmament which cannot be séene, although the night be neuer so cleare. This starre (as the Poet Homer saith) doth moue little or nothing, because of his litle distance from the Pole. The other Pole is imagined on the other contrary part, & is called Polus Antarcticus, of the word Anti, which signifieth against, contrary, or opposite, because it is on the contrary part from the Pole Artike. It is also called the South Pole, because that from that part of heauen commeth the Winde, commonly called the South, and is likewise called Meridional, because it is right South from vs. This is neuer séene to vs; they that dwell vnder the Equinoctiall, or come neare vnto this Pole Antartike, haue for a signe or marke to know it, foure Starres, in forme of a Crosse. And when the greatest of these is lowest in the foote of the Crosse, they say it is xxx. degrées aboue the Pole. And as we cannot sée their Pole from hence, so they cannot sée our Pole from thence.

CHAP. XI.
Of the Zodiacke Circle.

The Zodiacke is defined to decline or bend it selfe from the Equinoctiall. It is a great Circle, which deuideth the Spheare in two equall parts, cutting the Equinoctiall by oblique or crooked Angles: so that being thus cut or deuided by it into two equall parts, one part thereof declineth towards the south, and the other toward north. This Circle is called the Zodiacke of this word Zoce, which in the Gréeke tongue signifieth life, because that according to the mouing of the Planets vnder it, is the life of inferiour Creatures: Or is so named of Zodion, which signifieth a liuing beast, and is therefore deuided into twelue equall parts, whereof euery part is called a signe, and euery signe hath an especiall name of some beast, in respect of some pro-

perty agréeable to the same: or for the order and disposition of the fixt starres in those parts, somewhat representing the similitudes of such beasts, it is called Zodiacke. The Latines called this Circle, Signifer (that is) the signe bearer, because it carrieth these signes or Images in it, also because the twelue parts, into the which this Circle is diuided, are called the twelue signes. The part which declineth to the North containeth fiue signes septentrionall, and the other that declineth to the south, containeth other fiue called Meridionall. Furthermore, it is to consider, that the zodiacke may be deuided in two maners. One, by longitude or length into the twelue signes aforesaid, and euery signe is diuided into xxx. degrées, which make CCCIx. degrées, likewise euerie degrée is diuided into lx. minutes, and euery minute into lx. seconds, and euery second into lx. tertes, and so to ten. The other deuision of the zodiacke is, by latitude or breadth. By latitude it is deuided into xii. degrées, and in it we imagine a lyne that deuideth his latitude by the middest, hauing fiue degrées on euery part or side. And this line which diuideth into two equall parts, the breadth or latitude of the zodiacke is called the Ecliptike line, because that when the Sunne and Moone are directly vnder this line, either ioyned together by conjunction, or diuided by opposition, then is the Eclipse of the Sunne or of the Moone. Vnder this zodiacke the seuen planets are moued. The sunne also moueth in the middest of the said zodiacke, alongst the Ecliptike line, not enclining more to the one part then to the other. But the other planets doe some time goe toward the north, and other whiles toward the south, and some time also toward or trauerse the Ecliptyke. It is likewise to be noted, that these signes whereof we haue spoken, are not the constellations or starres that make those figures, which the ancient Astronomers did appropriate to certaine beastes and other things. For these figures are moued according to the motion of the eight Spheare, and passe from one signe of the zodiacke to another: As we see that the starre called Oculus

lus

lus Tauri (that is) the Bulls eye, is in three degrées, 42′. of Gemini. And the two starres that are the head of Gemini, are in xiii. and vi. degrées of Cancer. And Spica Virginis (that is) the spyke of the Virgine is in seauenténe degrées, 42′. of Libra, and the heart of Scorpio in three degrées, 42′. of Sagitarius. And by this order doe they passe from one signe to another: so that we may not vnderstand the signes by these starres, but the xii parts of the Arke of the zodiacke taking the beginning of the Equinoctiall of Aries. The names of these signs, with their Caracters and qualities are described in this table here following.

Numb.	*Names.*	*Charac.*	*Qualities.*
1	Aries.	♈	Hote and drie.
2	Taurus.	♉	Colde and drie.
3	Gemi.	♊	Hote and moist,
4	Cancer.	♋	Colde and moist.
5	Leo:	♌	Hote and drie.
6	Virgo.	♍	Colde and drie.
7	Libra.	♎	Hote and moist.
8	Scorp.	♏	Colde and moist.
9	Sagit.	♐	Hote and drie.
10	Capr.	♑	Colde and drie.
11	Aqua.	♒	Hote and moist.
12	Pisces.	♓	Colde and moist.

CHAP. XII.

Of the Circles called *Coluri*.

There are two Circles in the spheare, called Coluri, so named of the Gréeke word Colon, which signifieth a member: And of Vros, which signifieth a wilde Ore. The tayle of this beast, maketh a Semicircle or halfe circle, not perfect. And as this beast moueth his tayle laterally or side wayes, and not by longitude: euen so doe the Colury moue to vs, and are cut in right spherical Angles, vpon

the Poles of the world. The one passeth by the poles of the world, and by the points of the Equinoctialls, and is called the Equinoctiall Colure; the other likewise passeth by the Poles of the world, and also by the Poles of the zodiacke, and by the pointes of the Solsticialles, and is called the Colure Solsticiall, called Solstitium, as Solis Statio (that is) the standing or staying of the sunne, because that when the Sunne commeth to this point, it declineth no more, but turneth toward the Equinoctiall. These Circles deuide aswell the Equinoctiall as the Zodiacke into foure equall partes, by the points of the Equinoctialls, and Solstitialles. In the Colure Solsticiall, are the greatest declinations of the Zodiacke, which are two Arkes of this Colure, contained betweene the Equinoctiall and the Zodiacke. And these Arkes are equall to the other two of the same Colure, included betweene the Poles of the world, and the Poles of the Zodiacke.

CHAP. XIII.

Of the Meridian Circle.

The Meridian is one of the great Circles, imagined to traucrse the Spheare by the Poles of the world, cutting the same in two equall parts by the Zenith or verticall point: It is called Meridian for this effect, that whersoeuer a man becommeth, and at what soeuer time of the yeare, when the sunne (by the mouing of the first moueable) shall come to the Meridian, to him shall it bee high noone at midday, and is therefore also called the circle of the midday. It is also to be noted, that there are as many Meridians, or Meridian lines, as are differences or habitations by longitude, so that they that dwell in the East, haue other Meridians then they that dwell in the West: so that the interposition of the Arke of the Equinoctiall, betweene the Meridian of one City, and the Meridian of the other, is called the difference of longitude from one region to another, and from one City to another, as we will further declare hereafter.

CHAP.

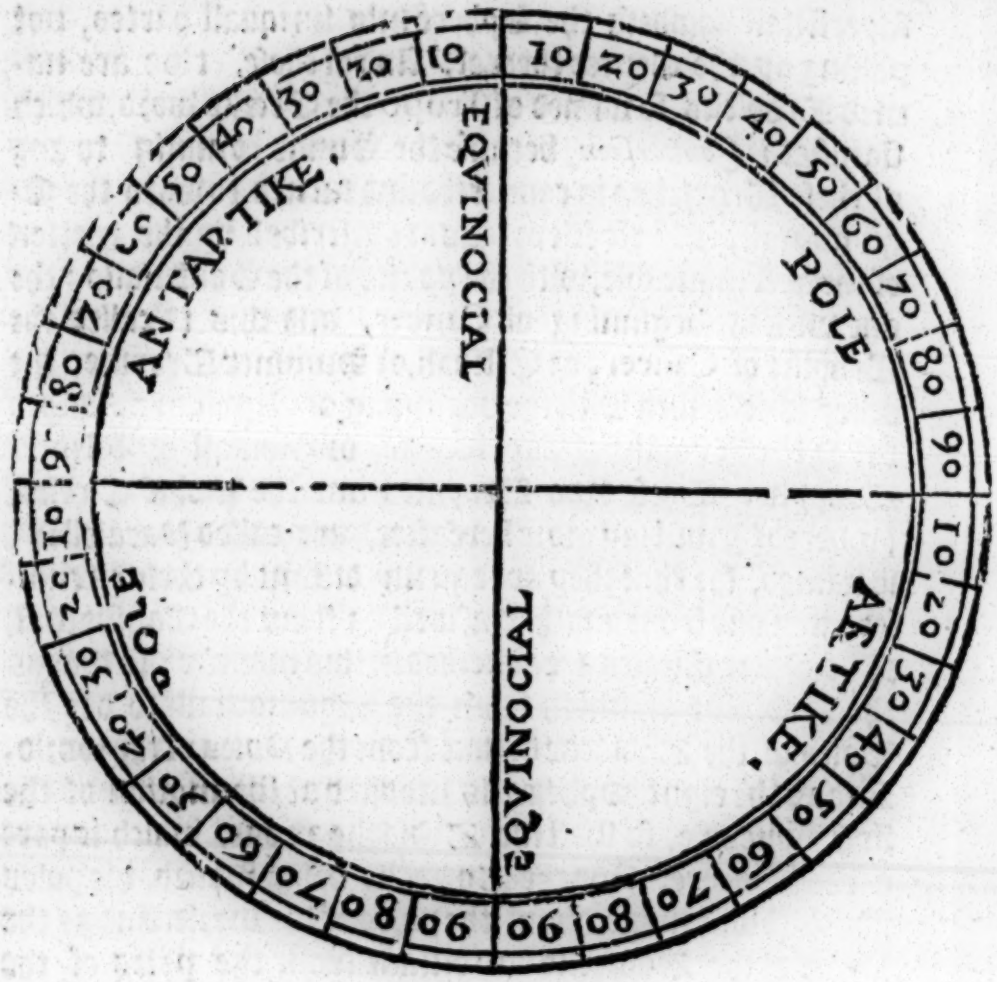
CHAP. XIIII.
Of the Horizontall Circle.

THe Horizon (after the Astronomers) is a Circle which deuideth that part of the heauen which we doe see, from the other part which wee see not, so that the saide Horizon deuideth the Sphearе of the world into two equall halfes, called Hemispheres. The halfe which we doe see is called the Hemisphere supertour, and it which we see not, is called the Hemisphere inferior. This Horizon changeth to them that moue: for as one doth moue, his Horizon doth change. And hereof it commeth, that how many places are vpon the earth, and the circumference thereof, it is possible there should be so many Horizons. The Astronomers suppose the Horizon after two manner of sorts, that is to say, a right Horizon, and an oblique, or crooked Horizon. The right Horizon, is to them whose Zenith or verticall point is directly in the Equinoctiall: and this right Horizon passeth by the Poles of the world, and diuideth the Equinoctiall in right spherицall Angles. The other oblique or declined Horizon haue they, vnto whome the Pole of the world doth rise aboue their Horizon. This Horizon is also called oblique, because it diuideth the Equinoctiall in vnequall and obtuse, or acute Angles.

Also it is to be vnderstoode, that the Pole of the Horizon is called Zenith, or the verticall point of heauen, perpendicularly, or directly ouer our head. Whereby is inferred, that as much as is the elеuation of the Pole of the world aboue the Horizon, so much is the distance of the *Zenith* from the Equinoctiall. For the Zenith by all his parts, is distant from the Horizon by ninety degrees. And all other impedtments excluded, we may euer see halfe the heauen: And in as much as any shall passe from the Equinoctiall towards the one Pole or the other, so much falleth the Horizon vnder or beneath the Pole, toward the course hee entendeth, and likewise as much shall it be rayled aboue the contrary Pole

as shall appeare by a demonstration in the end of this Chapter. This Horizon is deuided by the Meridian into two equall parts: that is to say, the East and West parts of the said Horizon. The East part is, where the Sunne and Starres beginne to arise to vs, and appeare in our sight: the West part is, where the Sunne and Starres doe set and begin to be hid out of our sight, vnder the said Horizon: moreouer it is to be vnderstoode, that there bee two manners of the East and West, that is to say, the true East and west, or the vntrue. The true East, is the point in the East part of the Horizon, where it doth cut with the Equinoctiall: for when the Sunne is in the points of the Equinoctiall, then he riseth in the point of the true east. And likewise is to be vnderstoode of the point of the true West, to bee in the west part of the Horizon, where the Equinoctiall doth cut with the said Horizon. The vntrue East and west is variable, according as the Sunne riseth and setteth dayly in diuers points of the Horizon, which is distant from the points of the true East and West, sometimes more to the Northward, and sometimes more to the south: which said distancing of the Sunne, Moone, or starres rising, or the true east or West is called the amplitude thereof: for looke how many degrées that the Sunne or starres rise or set, eyther to the northward or southward of the true East and West, so much is the amplitude thereof saide to be. From the Horizon is recounted all degrées of eleuation or altitude towards the Zenith, also vpon the Horizon are distinguished the 32. points of the Mariners Compasse, of which more particularly is afterward spoken: and for the better explaning of the said Horizon Circle, behold this Figure, where you see that when the ☼. Poles are in the Horizon, then is the Equinoctiall in the Zenith or right ouer your head, and then are both the Poles in your sight: but if you depart from the Equinoctiall towards eyther of the Poles, then looke how much your Zenith is from the Equinoctiall so much is the Pole eleuated aboue your Horizon, as this said Figure more plainely sheweth.

CHAP.



CHAP. XV.

Of the foure lesse Circles.

HAuing entreated of the vi. biggest Circles, it remayneth to speake of the foure lesse Circles.

A lesse Circle (as we haue saide before) is that whose superficiall deuideth the Sphere into vnequall partes, not passing by the Center thereof. And of these, two are named Tropicks. so named of Tropo the Greeke word, which signifieth *Conuersion*, because the Sunne commin to any of these Tropicke is conuerted and turned toward the Equinoctial'. These Tropicks are described by the motion of the first moueable, with the points of the Solstitialls: the one with the beginning of Cancer, and this is called the Tropike of Cancer, or Estiuall, or Summer Tropike; the other is described with the beginning of Capricorne, and is called the Tropike of Capricorne, or Hiemall or Winter Troppke. These two Tropikes and the Polar Circles, (whereof I will say more hereafter) are called Paralelles, so named, for that they are equally distant by their circumferences one from another, aswell as from the Equinoctial, The Polar Circles are described in this manner: so that as the Zodiacke declineth from the Equinoctiall, so doe the Poles of the Zodiacke decline from the Poles of the world. And as the eight Spheare is mooued at the motion of the first moueable, so shall the Zodiacke moue, which is part o the Spheare. And the Zodiacke being mooued, his poles shall likewise moue about the poles of the world. And as the Poles of the Zodiacke are distant from the poles of the world 23. degrees and a halfe (which is as much as the greatest declination) they shall describe certaine circles distant from the poles of the world, in the selfe same 23. degrees, and a halfe: these polar Circles take their name or dominion of that pole of the world, that is most neare vnto them, and therefore is the one called Artike, and the other Antartike: the Artike is the North pole, beeing that which is apparant to those which are to the Northward of the Equinoctiall, and the Antarticke is the South or opposite thereto.

CHAP. XVI.

Of the fiue Zones.

The ancient Astronomers deuided the Spheare into v. Zones: the first from the pole Artike, to the Cir-

cle

cle Artike. The 2. from the Circle Artike to the Tropike of Cancer. The 3. from the Tropike of Cancer, to the Tropike of Capricorn. The 4. from the Tropike of Capricorn to the circle Antartike, the 5. from the circle antartike to the pole antartike. Of these 5 Zones they haue certain knowledge, that 2 of the poles were vnhabitable for extream cold: and also that the burnt Zone (called Torrida Zona) whereby the Sunne passeth by the middest of them, should be vnhabitable for extreame heate. That from the Tropike of Capricorne, vnto the Circle Antartike, they called desert, because they knew not that it was inhabited. And this our Zone, that is, from the Tropike of Cancer, to the Circle Artike, they called inhabited or habitable: and to haue more perfect knowledge hereof, it is to imagine, that the earth is diuided proportionally into fiue Regions or portions, which answere directly to the said fiue zones, as saith the Poet Ouid in this verse:

Totidemque plagæ tellure premuntur. (That is)
And so many Regions are on the earth beneath.

Euery of these Regions or portions of the earth, is situate vnder one of the fiue Zones aforesaid. But whereas certaine men of authority haue moued the question, whether the earth vnder the Zone, from the Tropike of Cancer, to the Circle Antartike, is desert or no: Ptolomie and the Astronomers affirme that it is vnpeopled. But Aristotle and Ouid in the second of his Metamorphosis: Plinie, also and Iohn de sacro Bosco, affirme the contrary, as for the more certainety thereof we know the experience of such as goe and come dayly from those partes. Moreouer then this, we know that that land is not onely well replenished with people of good corporature, and of white colour, but the same to be also very rich in gold. For they that sayle to the East Indies, touch in the Cape of Buena Speranza, or Caput bonæ Spei, which is in this zone. Likewise the land of Brasile and the confines of Rio de la Plato, with all the coast vnto the straights of Magalanes, euen vnto 54. Degrees of South, This land was discouered by Magalanes,

galanes, in the yeare 1520. or 1521. whereby that is now well knowne by sight, whereof Ptolomie had no knowledge by heare say. The burnt Zone (called Torrida zona) they also described to be vnhabitable, by reason of the great heate thereof, as Aristotle, Plinie, and in manner all other ancient Authors affirme, whereof the Poet Virgil writeth thus,

Quinque tenent cœlum Zonæ, quarum vna coruſco
Semper ſole rubens, & torrida ſemper ab igne.

Which in the English tongue is thus much to say in effect:

In Zones fiue, the heauens contained be,
Whereof the one with burning Sunne is red,
Scorching the earth subiect to his degree,
That for the heate thereof it is vnhabited.

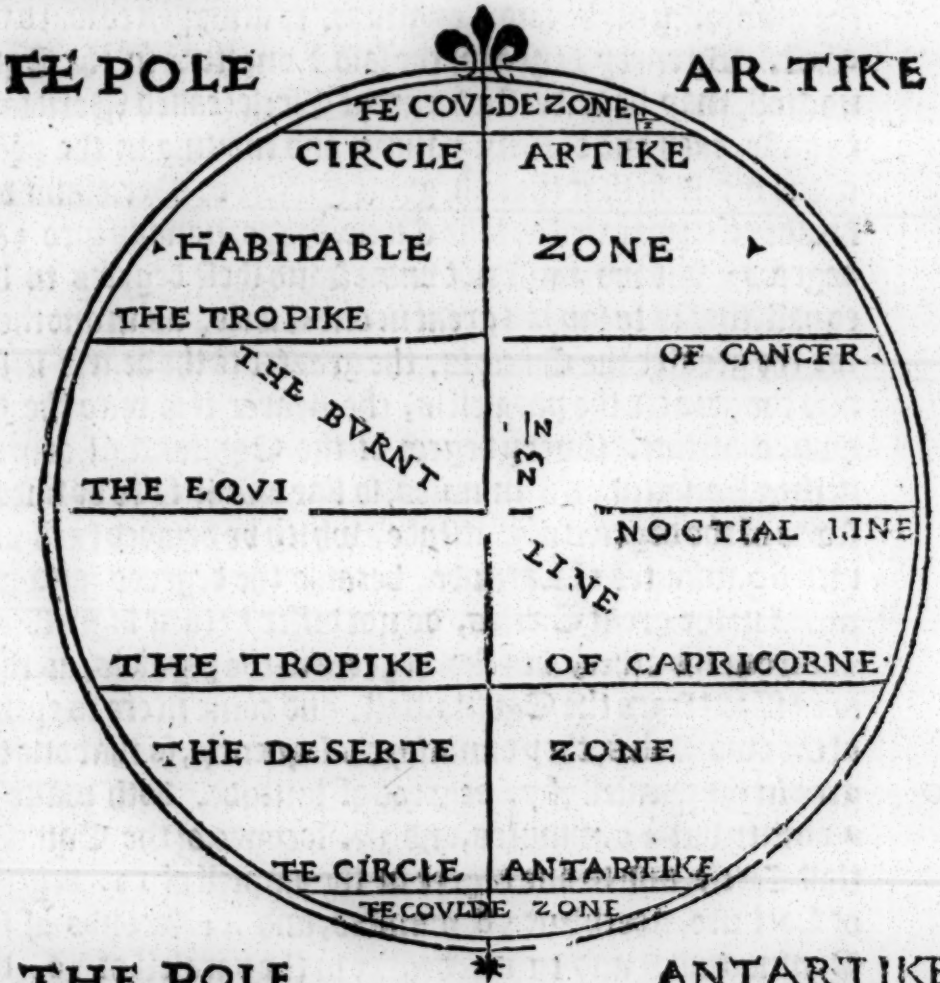
Likewise Ouid in his Metamorphosis, toucheth the same, saying,

Quarum quæ media eſt, & torrida ſemper ab igne, &c.

Yet that the burnt Zone is inhabited, and well replenished with people that liue there, wee know so certainely by the number of them that dayly passe to and fro from the Indies, that to say any thing to the contrary, it should be a manifest error, and therfore it is greatly to be maruailed, that certaine wise men haue affirmed these parts to be vnhabitable; whereas neuertheless they had knowledge of Arabia Fœlix, AEthiopia, Taprobana, and diuers other Regions situate vnder the burnt Zone. Plinie writeth, that a shippe came from the sea of Persia by the Ocean, round about Ethiope, and came to the pillers of Hercules, which is now the City of Cadiz, where at this present, I writ this briefe treatise. They of Guinea, Calicut, Gatigara, and Malaca, liue all vnder the burnt Zone, and many of them liue very long: And doubtlesse, many things ought to perswade vs, that vnder the burnt Zone, the earth is furnished with all things pertayning to the life of man: for that in that region, or portion of the earth, is in manner continuall Equinoctiall, or equality of dayes and nights, whereby the coldnesse of the night doth sufficiently temper the heate of the

day

day: againe, they that inhabite vnder that Zone, haue two Sommers and two Winters in the yeare: whereby is concluded that the ancient authours erred, not only in affirming this Zone to bee vnhabitable by reason of the great heate thereof, but in like manner erred, in affirming the Zone that is betweene the circle Artike, and the pole Artike, to be also vnhabited by reason of great cold. The contrary whereof, we may well affirme, knowing as we know that Island, with part of Gothland, Norway, Russia, and diuers other Lands are inhabited and well peopled. For the better explanation whereof, behold this following portrature, which plainly distinguisheth euery one of the said 5. Zones in his particular place.



CHAP.

CHAP. XVII.

Of Longitude and Latitude, and of the proportion which the lesser Circles haue to the great Circle.

The Spheare or Globe of the earth is also diuided in breadth and in length. The breadth (which is called latitude) is by degrées, for from the Equinoctiall to eyther of the two poles, is 90. degrées. The length (which is called longitude) is by the degrées of the Equinoctiall, which is diuided in 360. degrées The first degrée of Longitude doth begin at a certaine Meridian, which passeth by the Ilands of the Azores, called the fixed Meridian, and the order of the numbring of the said Longitude, is alwayes toward the East. By euery degrée of the said Longitude in the Equinoctiall, may be vnderstood a great Circle (called Meridian) to passe, each one of them passing and méeting in the poles of the world, so that the said great Circles or Meridians doe deuide euery paralell or lesse Circle, proportionally into 360 degrées: but we must not vnderstand these degrées to bée equall (that is to say) as great in one Circle, as in another: for the greater the Circle is, the greater is the degrée in it: and the greater the paralell is, the nearer it is vnto the Equinoctiall line. Euery degrée of the Equinoctiall, containeth in Longitude 60 minutes, so likewise it is to be vnderstoode of the degrées of Latitude, which be deuided each one into 60. minutes of Latitude, because the degrees and minutes in the great Circles, do not differ in their bignesse the one from the other, but the degrees in the paralels, as they are distant from the Equinoctiall, and come neere to eyther of the two Poles, they diminish consequently, so that one degree in the paralell of 7. degrees of latitude, doth make in quantity but 59. minutes, and 33. seconds of the Equinoctiall Circle, and to one degree in the paralell of 12. degrees of Latitude, goeth but 58 minutes, and 41. seconds of the Equinoctiall, and to one degree in the paralell of 16. degrees

grees of Latitude, there goeth 57. minutes, and 41. seconds, and so diminishing till you come to the Poles, so that in the paralell of 60. degrees, one degree is but halfe a degree of the Equinoctiall, and that you may know how many minutes of the Equinoctiall make a degree in any paralell, betwixt the saide Equinoctiall, and eyther of the poles, behold this Table following: the first Colume whereof sheweth the degrees of Latitude, from the Equinoctiall toward the pole, the nert two Colums shewes, the first the minutes, the second the seconds, answerable to a degree of Longitude in the same Latitude: Againe, the 4. collume are degrees of Latitude, and the 5. and 6. minutes and seconds answerable to a degree of Longitude, and so consequently euery 4. colume degrees of Latitude, and the two next minutes and seconds of a degree of longitude in the same paralell.

The Table of minutes, which euery degree containeth in euery of the Paralelles.

G	M	S	G	M	S	G	M	S	G	M	S	G	M	S	G	M	S
1	59	59	16	57	41	31	51	26	46	41	41	61	29	55	76	14	31
2	59	58	17	57	23	32	50	53	47	40	55	63	28	10	77	13	30
3	59	55	18	57	54	33	50	19	48	40	49	63	27	14	78	12	28
4	59	51	19	56	44	34	49	45	49	39	22	64	26	18	79	11	27
5	59	46	20	56	23	35	49	49	50	38	34	65	25	21	80	10	25
6	59	40	21	56	11	36	48	32	51	37	46	66	24	24	81	9	23
7	59	33	22	55	38	87	87	55	52	36	56	67	23	27	82	8	21
8	59	25	23	55	17	38	47	14	53	36	7	68	22	26	83	7	19
9	59	16	24	54	49	39	46	38	54	35	16	69	21	30	84	6	15
10	59	5	25	54	23	40	45	58	55	34	25	70	20	31	85	5	14
11	58	54	26	53	56	41	45	17	56	33	33	71	19	32	86	4	11
12	58	41	27	53	28	42	44	35	57	32	41	72	18	32	87	3	8
13	58	28	28	52	59	43	43	53	58	31	48	73	17	33	88	2	5
14	58	13	29	52	29	44	43	10	59	30	54	74	16	32	89	1	3
15	57	57	30	51	58	45	42	26	60	30	0	75	15	32	90	0	0

CHAP

CHAP. XVIII.

Of the circuit or Compasse of the Earth and water, according to the opinion of the ancient and later Authors.

IT may here appeare to be necessary for our purpose, to declare what space of the superficies of the erth or water, the auncient writers did suppose to answere to one degrée of a greater Circle in the heauen: for in diuers Countries they vsed to count by diuers sorts or manner of measures: as the Latines counted by myles, the Greekes by furlongs, the Spaniards and Frenchmen by leagues, the Egyptians by signes or markes, and the Persians by saguas. But they all agree that foure grains of Barley make a finger breath, foure fingers, a hand breadth, foure hands a foote, fiue foote a Geometricall pace (for two simple paces make fiue feete.) Also 125. Geometricall paces, make a furlong, eight furlongs, one mile, which is a thousand paces, and three miles one league. In Germany they make leagues of more feet, and in some places more then in other. In France, they count thirty leagues to one degree. The Spaniards count sixteene leagues and two terces, and seauenteene and a halfe for a degree of the great Circle: this difference that one league is bigger then another, may come hereof, that one Barley corne is bigger then another. But to our purpose, let vs giue to euery league three thousand paces, and to euery pace 5 foot and so shal euery league haue xv. thousand foot. In the cardes of the sea, that haue their degrees of xv. leagues and two terces, wee say, that of these, the roundnesse of the land and the water containeth sixe thousand leagues. And in the Cardes that haue seauenteene Leagues and a halfe for a degree: Of these wee say that it containeth six thousand and three hundred Spanish leagues: and of english leagues the whole circumference is 7200. by which whosoeuer is desirous to know the Diameter of the

whole

whole body of the earth and water, know that the neareſt proportion that hath hitherto beene found of a Diameter to his circumference, is as 7. to 22. therefore if you say by the rule of proportion, if 22. giue 7. what shall 7200. giue, the Quotient will bee 2290$\frac{10}{11}$ Leagues: for the whole Diameter of the earth and water, the halfe whereof bæing 1145$\frac{10}{22}$. is the Semidiameter or distance from the superficies of the earth to the Center thereof.

CHAP. XIX.
Of the seauen Climates.

The auncient Authors did also diuide that parte of the superficies of the earth on the North side of the Equinoctiall, which they supposed to be most habitable, into seauen Climates, wherein they did finde to bee diuers conditions and customes of men, and diuersities of beasts, and of other naturall things: the which things they perceyued to haue a diuersity in the countries, as where the day of the one did encrease or differ aboue the day of the other by halfe an howre, so that the space of the superficiall of the earth, betweene two paralell lines, wherein the longest day doth encrease or differ by halfe an houre, is called a climate. The place where they suppose the first climate to beginne, is distant in Latitude from the Equinoctiall by 12. degrees, and 45. minutes, where the longest day is 12. howres, and 45. minutes, and the place where the seuenth climate doth finish, is in the Latitude of 50. degrees, and 30. minutes, where the longest day is 16. howres, and 15. minutes, so that the increase of the longest day in the end of the seuenth climate, doth exceede it in the beginning of the first climate by three howres and a halfe, & the whole compasse of the earth, with all the seauen climates doth containe in breadth 37. degrees, and 45. minutes, but their length is supposed to extend to 180. degrees of Longitude. In that manner, a climate, the nearer it is vnto the Equinoctiall, the more it containeth of the superficiall of the earth, because

the paralell circles the nearer they bee vnto the equinoctiall the greater is the compasse of the earth which they make in length: and the lesser the compasse is, the nearer they bee vnto the poles, as doth appeare euidently by the Meridians, where they doe all concurre, and meete in the poles, their distances waxeth continually lesser and lesser, the nearer they be vnto the said poles, so that the nearer the climate is vnto the pole, the lesser it containeth of myles in the length. In like manner shall you vnderstand that greater is the breadth of the first clime, then of the second, and the second then the third, and likewise of the other. For in how much the more from the Equinoctiall you come neare to the pole, so much the more is the spheare oblique or crooked, and consequently the day encreaseth more. by reason whereof, in lesse space is found the encreasing of halfe an howre, in which the climate maketh difference, and doth vary. Which thing shall be more manifest to him that beholdeth the Latitude of them all, as may appeare by the Table here following: In which you may see the howres, which the greatest day containeth of euerie climate in his beginning, middest and end, with also the eleuation of the pole or distance from the Equinoctiall, and also the degrees of Latitude, which euerie Climate containeth.

	The longest day.				The elevation of the Pole.				Differences	
Clima.	Begin.		Midst	End.	Beginning.		Midst.	End.	of the latitude	
	ho.	P	ho.	P	ho.	P	G	P	G	P	G	P	G	P
1	12	45	13	0	13	15	12	45	16	40	20	30	7	45
2	13	15	13	30	13	45	20	30	24	15	27	30	7	0
3	13	45	14	0	14	15	27	30	30	45	33	40	6	10
4	14	15	14	30	14	45	33	40	36	24	39	0	5	20
5	14	45	15	0	15	15	39	0	41	20	43	30	4	30
6	15	15	15	30	15	45	43	30	45	24	47	15	5	45
7	15	45	16	0	16	15	47	15	48	40	50	30	3	15
8	16	15	16	30	16	45	50	30	51	58	53	17	2	47
9	16	45	17	0	17	15	53	17	54	29	55	34	2	17

The

The first Climate is called Dia Meroes, Meroe is a City of Affricke, vnder the burnt Zone, on this side the Equinoctiall, 16. degrées.

The second is called Dia Siena: Siena is a Citty in the confines of Ethiope, where there is a Well that sheweth the Summer Solstitiall, because that place is vnder the circle of the Tropicke of Cancer, and the Sunne séemeth to stand directly ouer that place at mirday of the Solstitial, whereby the Well is then very cleare, and hath in it no shadow at all, as the Poet Lucan maketh mention in Farsalia where he sayth;

Vmbras nusquam flectentes.

That is to say, Shadowes no where reflecting.

The third is Dia Alexandros, Alexandria is a famous City in Affricke, builded by great Alexander, and is the chiefe Citty or Petropolis of Egypt.

The fourth is Dia Rhodos: Rhodes is an Iland of Asia the lesse, where were sometimes the Knightes of the Rhodes, called the Knights of the order of Saint Iohn, or Knights of Ierusalem, who were driuen from thence when the Iland and City was taken by Sultan Soliman, the great Turke in the yeare 1522. Philip Vrlerio Frenchman, being then Grandmaster of the Rhodes. Within this fourth Climate is the City of Ierusalem, within the holy land called Palestina, and also a great part of Spaine with many other Prouinces.

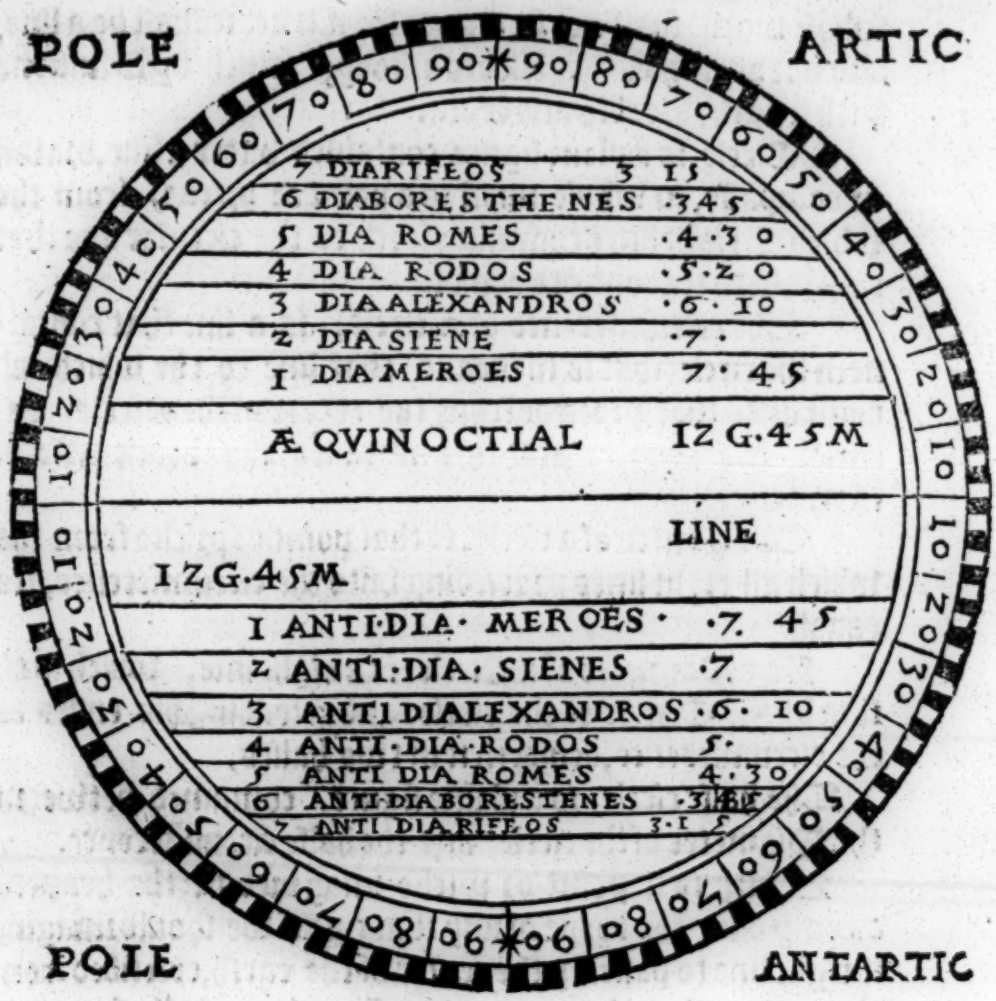
The fift is Dia Romes, Rome is the most famous City of Italy, and most notorious of all Europe, somtimes the head of the world, Dominatrix of Nations, and now the Sée of the Bishop of Rome.

The first is, Dia Boristhenes, Boristhenes is a great Riuer of Scithia, the fourth arme of the Riuer Istro. It falleth into the sea Euxinum, and whereas all other riuers of Scithia are troubled, this is cleare and faire, also wholesome to be drunke and full of Fishes.

The seuenth Climate, is called Dia Rifeos. The Mountaines called Rifei, are famous in the part of Europe called Parmatia, and are continually couered with Snow. Out of these, springeth the River Tanais, well knowne in the World by fame. When it is written with ph. it is the name of certaine Mountaines of Arcadia. And here ought wee not to bee ignorant, that whereas the Authors assigned onely seauen Climates, they might haue made many more: And for that they iudged the part of the Pole Antartike not to bee inhabited, they assigned no Climates thereto.

To these seauen Climates, the later Cosmographers haue added two more, which they call the eight and the ninth, beginning where the seuenth Climate ends, and continuing to fifty fiue degrees, 34'. of Latitude, the eight Clime passing through Meotis, and the ninth through Denmarke. Both which Climates are hereunto added with the length of the longest day, and the eleuation of the Pole, both at the beginning, middest and end of the saide Climes. In like manner describing Meridionall or south Climates: we call them by the selfe same names, as we did the foresaide Septentrionall or North Climates, sauing that it is necessary to put before euery of them this Græke preposition Anti, which in the Latine tongue signifieth Contra or Contrarium (that is) contrary or against. So that as we named the first North Climate, Dia Meroes, we must to the first of the South, adde this word Anti, and so shall the first South Climate be named Anti Dia Meroes: The second, Anti Dia Sienes, and so forth of the other, as is séene in the figure here following.

CHAP



CHAP. XX.

Of certaine Principles that ought to be knowne for this Science.

IN treating of the Sphæare, wee haue spoken of Circles, Circumferences, Centers, Diameters, Lynes, with such other words appropriate to this Science, the which what they are, it is conuenient further to declare.

A right Line, is a short Extention from Point to point.

An Angle, is the touching of Lines in one superficiall, whose touch shall not be direct, for if it be, it shall be a line, and not an angle. Solide is a body, which by Diuisions hath length, breadth and depth.

A Circle is a plain figure contained vnder a line, drawn in compasse, in whose midst is a point or pricke, from the which all right lines comming forth to the circular line that compasseth it about, are equall.

The circumference of a circle, is a line that containeth the circle (that is to meane) that line to the which all right lines that proceede from the center of the Circle, vnto it, are equall: and this is called the roundnesse of the Circle.

The Center of a circle, is that point or pricke from the which all right lines proceeding vnto the circumference, are equall.

The Diameter of a Circle, is a right line, which passing by the Center of the circle, and extending his endes to the circumference, deuideth it in two halues.

The halfe circle, is a plaine figure, contained betweene the Diameter of the circle, and the halfe circumference.

Zenith is a point or pricke imagined in the heauen, directly ouer the toppe of any thing, as if we should imagine a right line to passe by the center of the earth, extended from thence directly to heauen, and passing through the feete and head of a man standing vpright, so that the extremities or endes of this line, should reach vnto, and touch the circumference of heauen: then the imagined point or pricke of heauen, where the end of the line toucheth is called Zenith, or point of the head, or verticall point: the same is to bee vnderstood of a City, or any other thing, when wee speake of the Zenith thereof.

Eccentricke is a circle, which hath his center distant or diuided from the center of the world, and is described in the Heauen of the sunne, imagining a Line from the center of the Eccentricke, to the center of the sunne, making

a com-

a complete reuolution at the proper motion of the Sunne, in the other heauens, imagining a line from the Center of his Eccentricke, to the center of his Epicicle, and being moued a whole reuolution at the proper motion of the Epicicle.

The Epicicle, is a circle or little rundell fixt in the depth of the Eccentricke: in which the Planet fixed, and nære to his Center, is moued circularly.

The Auge is a point in the circumference of the Eccentricke, nearest vnto the firmament, or it may be sayde that the Auge is a point farthest distant from the earth. Aux in the Greeke tongue is as much to say, as the greatest Longitude or the greatest elevation from the Earth. The Oppolite of Auge is an other point in the Circumference of the Eccentricke, nearest vnto the earth, and fardest distant from the Firmament.

Here endeth the first Part.

THE SECOND PART,
Entreating of the Motions of the *Sunne, and the Moone and* the Effectes cauſed *thereby.*

CHAP. I.

Of the Courſe of the Sunne in the Zodiacke, and the Effects cauſed by the ſame.

E haue briefly ſpoken of the Sunne and of the other Heauens: But for as much as the ſunne muſt bee our marke, guid, and gouernour in Nauigation, whereof wee entend to giue perfect inſtructions, it ſhall be neceſſarie eſpecially and preciſely to declare the courſe and motions thereof. Therefore (as we haue ſaid) the Sunne is moued vnder the Zodiacke, and vpon his Poles in the line Ecliptike, paſſing by the xii. Signes, beginning in the firſt Degree of Aries, where he maketh Equinox, that is to ſay, he maketh the day equall vnto the night in all places. Then from Aries he entreth and moueth into Taurus, approching nearer and nearer vnto vs on the North part, whereby the length of the dayes are encreaſed with vs, and the nights are ſhortened. Then entreth he into Gemini, and from Gemi-

ni

ri, into Cancer, where in the beginning of the first Degree, hee maketh Solstice, and toucheth the summer or Estiuall Tropicke, and then are the dayes longest with vs, and the nights shortest. Then declineth he no farther from the Equinoctiall, but returning toward it, passeth by this signe, shortening the dayes to vs, and lengthening the nights. From this signe of Cancer, it entreth into Leo, and passeth by it into Virgo, and by it entreth into the first degree of Libra, where hee is in the Equinoctiall, and then he maketh the other Equinox, so that the night is then equall vnto the day ouer all the world. And passing by this signe, goeth declining from the Equinoctiall toward the pole Antartike, increasing the nights to vs, and shortening the dayes, and so entreth into Scorpio, and from thence into Sagitarius. And passing by it entreth into the first degree of Capricorne, to the Hiemall or Winter Tropicke, and then are the longest nights vnto vs, and the shortest dayes. From hence he returneth toward the Equinoctiall, shortening vnto vs the nights, and lengthening the dayes. Hee passeth by this signe of Capricorne, and entreth into Aquarius, and passing by it, entreth into Pisces, and passing from thence, returneth to his first point of the Equinoctiall of Aries where he began. Hereby it followeth, that as the sunne goeth the halfe of the Zodiacke on this part of the Equinoctiall, and the other halfe on the other part of it, and in these halfes hath diuers declinations, is caused the increasing or decreasing of the dayes and nights, to one more, and to another lesse, according as euery one with his Horizon discouereth of the course of the sunne, by the little or much that he is departed or distant from the Equinoctiall, or as the pole is rayled aboue his Horizon: so that when as to them that are on this part of the Equinoctiall, is the longest day, and the shortest night: euen so to them on the other part, is the longest night and shortest day. And contrariwise, when vnto vs is the shortest day, vnto them is the longest, which shall further appeare by euident demonstration in the last chapter of the third part,

The discréet Reader shall here note, that the Sunne is not moued regularly in the Zodiacke, making so much by his proper motion in one day, as in the other, because his regular motion, is in respect of the Center of his owne proper spheare or orbe, wherein he is moued, whose center is distant without the center of the world, toward that part of Cancer, so that the greater part of his orbe eccentricke, is toward the septentrionall part, where the Sunne passing by the septentrionall signes, is more distant from the earth, & hath more to goe of his orbe Eccentricke, then being in the south signes: for passing by the North signes, he tarrieth nine dayes more, to describe that halfe of the Zodiacke, then the other halfe toward the south part, and for that cause the Sunne is more swifter in his motion in the Zodiacke one time then another, for his motion in one day, in the south signes, shall bee greater then it is in one day in the North signes, as shall appeare in the table that followeth, whose vse is, for the finding of the motion, and true place of the Sunne in the Zodiacke for euery day of the yeare. And hereby it followeth of the said vnequall mouing of the Sunne, and by the obliquitie of the Zodiacke, certain dayes of Winter, with their nights, are longer then certaine other of summer, with their nights, that is to say; that the day naturall in the winter, doth surmount that in the summer, because the right ascension, which answereth to one dayes motion of the sunne, being in the south signes, is greater then the ascension for one dayes mouing being in the North signes.

Of this inequality of dayes and nightes throughout the world, it is most euident to those that trauaile in farre countries: for we see plainely, that vnder the Equinoctiall, the dayes and nights are of an equall length at all times, but departing from the said Equinoctiall towardes eyther of the Poles, the dayes are longer in summer then in winter, and the nights longer in Winter then in summer: so likewise the further from the Equinoctiall, the greater is the inequality, notwithstanding, so as the length of the night in win-

winter doth counteruaile the length of the day in summer: for wée see by experience that vnder the Equinoctiall, the dayes and nights are alwayes twelue howres a péece, vnder the Tropicke the longest day is thirteene howres and ½ in summer, and the longest night thirteene howres and ½ in Winter. In the south part of Spaine the longest day in Summer fouretéene howres and ½, and the longest night in Winter as much. Here in the South part of England the longest day in summer, fiftéene howres and some what more, and the longest night in Winter as much, and so consequently, the further from the Equinoctiall, the inequality of the dayes and nights encreasing more swifter, insomuch that far north or south they cannot count the length of their dayes by howres and minutes, but first by dayes and howres, then by weekes, and next by moneths and wéekes: and lastly, onely by monethes: for certaine it is that vnder eyther of the poles the day and night are againe equall, consisting of one day and one night, and the yeare consisting of fiue monethes, which is all the time that the sunne is in those signes, which are on the same side of the Equinoctiall, and the night being likewise other fiue monthes, the sunne then occupying the contrary signes: and to the end that without great labor or calculation you may know the length of the day in euery seuerall Latitude, I haue here annexed a table of the longest day in each seuerall Latitude.

CHAP.

Latitude. Degrees of	Length of the Day. H.	M.
0	12	0
3	12	10
6	12	20
9	12	32
12	12	42
15	12	53
18	13	5
21	13	17
24	13	30
26	13	42
31	13	56
32	14	6
34	14	16
36	14	27
38	14	38
40	14	51
42	15	4
44	15	19
45	15	26
46	15	34

Latitude. Degrees of	Length of the Day. H.	M.
47	15	42
48	15	51
49	16	0
50	16	10
51	16	20
52	16	30
53	16	42
54	16	54
55	17	7
56	17	21
57	17	36
58	17	53
59	18	11
60	18	31
61	18	53
62	19	18
63	19	48
64	20	24
65	21	10
66	22	20

Lati.	Length of the Day monr.	weeke	daies.	howrs
67	0	3	3	2
68	1	2	0	1
69	1	3	5	16
70	2	3	1	14
71	2	2	4	0
72	2	3	5	7
73	3	0	5	5
74	3	1	5	17
75	3	2	6	1
76	3	3	5	7
77	4	0	4	14
78	4	1	3	17
79	4	2	1	10
80	4	3	1	5
81	4	3	5	14
82	5	0	5	7
83	5	1	4	2
84	5	2	2	3
85	5	3	0	5
86	5	3	5	11
87	6	0	3	21
88	6	1	1	5
89	6	1	6	22
90	6	2	0	14

CHAP. II.

Sheweth the true place of the Sunne in the Zodiacke.

The true place of the sunne is a point or pricke in the Zodiacke which is thus found, viz. by drawing a right line

line from the Centre of the world, to the Centre of the sunne, and carrying the same right forth vnto the Zodiacke, the extreame point, or vtmost extension of which Line is the true place of the sunne, which is so also to bee vnderstoode of the moone and the other Planets, which said place of the sunne, is to be found diuers seuerall waies, chiefly by the Ephemerides, as also by the Globe, and other instruments, of which that described in the seuenth Chapter here following, is very plaine and easie, both for the ease of such, as haue not an Ephemerides, and yet desire more exactnesse then by instrumentes can be performed, this Table of the sunnes true place, with the Table of Equation thereto annexed will very truelie satisfie their expectations, which first Table of the true place of the sunne is truely calculated for this present yeare 1609. to finde which true place in any day thereof: looke in the Heade of the saide Table for the Moneth, and in the first colume at the left hand for the Day of the saide Moneth, and in the common Angle against the Day and vnder the Moneth, shall you finde the Number in Degrées and Minutes, with the signe ouer head, that the sunne possesseth the Day and Moneth desired in the yeare aforesaide.

A Table

A Table of the true place of the Sunne.

	January		Februar		March.		April.		May.		Iune.	
Dais	Capric.		Aquari.		Pisces.		Aries,		Taurus.		Gemini:	
	D.	M.	D.	M.	D.	M.	D.	M	D.	M	D.	M.
1	21	26	22	54	20	59	21	33	20	39	20	21
2	22	27	23	55	21	59	22	32	21	37	21	18
3	23	28	24	56	22	58	23	30	22	35	22	16
4	24	29	25	56	23	58	24	29	23	33	23	13
5	25	30	26	57	24	57	25	28	24	30	24	10
6	26	31	27	57	25	57	26	26	25	28	25	7
7	27	32	28	58	26	57	27	24	26	26	26	4
8	28	33	29	58	27	56	28	23	27	23	27	2
9	29	350	♓	58	28	55	29	21	28	21	27	59
10	0 ♒	361		59	29	550	♉	19	29	18	28	56
11	2	372		590	♈	541		180	♊	1629		53
12	2	383		591		532		161		130	♋	50
13	3	394		592		534		142		111		48
14	4	406		03		524		133		92		45
15	5	417		04		515		114		63		42
16	6	428		05		506		95		44		39
17	7	439		06		497		76		25		36
18	8	4410		07		498		56		596		34
19	9	4511		08		489		37		567		31
20	10	4512		09		4710		18		538		38
21	11	4613		010		4610		599		512		25
22	12	4714		011		4511		5710		4810		22
23	13	4815		012		4412		5611		4511		19
24	14	4916		013		4313		5412		4312		17
25	15	5017		014		4214		5113		4013		14
26	16	5118		015		4115		4914		3714		11
27	17	5118		5916		3916		4715		3515		8
28	18	5219		5917		3817		4516		3216		5
29	19	53				18		3718		4317		29
30	20	54				19		3619		4118		2628
31	21	55				20		35		19		24

A Table of the true place of the Sunne.

Dais	Iuly. Cancer.		Auguſt. Leo.		Septem. Virgo.		Octob. Libra.		Noueм. Scorpio		Decem. Sagitar.	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	18	57	18	36	18	36	18	6	19	7	19	33
2	19	54	19	34	19	35	19	6	20	7	20	34
3	20	51	20	31	20	33	20	5	21	8	21	35
4	21	49	21	29	21	32	21	5	22	8	22	37
5	22	46	22	27	22	30	22	5	23	9	23	38
6	23	43	23	25	23	29	23	4	24	10	24	39
7	24	40	24	23	24	28	24	4	25	10	25	40
8	25	38	25	20	25	26	25	4	26	11	26	41
9	26	35	26	18	26	25	26	4	27	12	27	43
10	27	32	27	16	27	24	27	3	28	12	28	44
11	28	30	28	14	28	23	28	3	29	13	29	45
12	29	27	29	12	29	22	29	3	0 ♐	14	0 ♑	46
13	0 ♌	24	0 ♍	10	0 ♎	21	0 ♏	3	1	15	1	47
14	1	22	1	8	1	19	1	3	2	16	2	49
15	2	19	2	6	2	18	2	3	3	17	3	50
16	3	16	3	4	3	17	3	3	4	17	4	51
17	4	14	4	2	4	16	4	3	5	18	5	52
18	5	11	5	0	5	15	5	3	6	19	6	54
19	6	8	5	58	6	14	6	3	7	20	7	55
20	7	6	6	56	7	13	7	4	8	21	8	56
21	8	2	7	54	8	13	8	4	9	22	9	57
22	9	1	8	52	9	12	9	4	10	23	10	58
23	9	58	9	51	10	11	10	4	11	24	11	59
24	10	56	10	49	11	10	11	4	12	25	13	1
25	11	53	11	47	12	10	12	5	13	26	14	2
26	12	51	12	45	13	9	13	5	14	27	15	4
27	13	48	13	44	14	8	14	5	15	29	16	5
28	14	46	14	42	15	8	15	6	16	30	17	6
29	15	43	15	41	16	7	16	6	17	31	18	7
30	16	41	16	42	17	7	17	7	18	32	19	8
31	17	39	17	40			18	7			20	10

A Table of the Equation of the Sunne.

Yeares of our Lord.	Equation to be aded M	Yeares of our Lord.	Equation to be aded M	Yeares of our Lord.	Equation to be aded M
1609	0 0	1631	24	1651	37
1610	45	1632	19	1652	2
1611	30	1633	0 5	1653	0 8
1612	15	1634	50	1654	53
1613	0 1	1635	35	1655	38
1614	46	1636	20	1656	23
1615	31	1637	0 5	1657	0 9
1616	16	1638	50	1658	54
1617	0 2	1639	35	1659	39
1918	47	1640	20	1660	24
1619	32	1641	0 6	1661	0 10
1620	17	1642	51	1662	55
1621	0 3	1643	36	1663	40
1622	48	1644	21	1664	25
1623	33	1645	0 7	1665	0 11
1624	18	1646	52	1666	56
1625	0 4	1647	37	1667	41
1626	48	1648	22	1668	26
1627	33	1649	0 8	1669	0 12
1628	18	1650	52	1670	57
1629	0 4				
1630	49				

But if you desire the true place of the sunne for any other yeare afterward, seeke in this Table of the Equation of the Sunne, for the yeare in which you desire the true place thereof, against which yeare so found, you shall see in the next Colume certaine minutes, these minutes adde vnto the degrees and minutes found against the day of your moneth in the former table of the Sunnes true place, and from the totall take one whole degree, except onely in those years against

against which before the Minutes is set a Cipher, and then are you onely to adde the Minutes without making any Substraction.

CHAP. III.
Of the declination of the Sunne.

The declination of the Sunne is the Arke of the greater circle, which passeth by the Poles of the worlde, included betweene the Equinoctiall and the Zodiacke. And here is to be noted, that whatsoeuer foure points or pricks which are equally distant from the points of the Equinoxes (which are the beginning of Aries and Libra) shall haue equall declinations.

Whereof it followeth, that the foure quarters of the Zodiacke haue equall Declinations. And to auoide prolixitie, I will adde hereunto a Table of the Declinations of onely one quarter of the Zodiacke, so that all hauing one selfe same manner of Declinations, it may serue for all, and the order of it is this; The signes whose declination increaseth, are in the head or front of the Table, and the degrees of these signes descend by the left side thereof. And the signes whose declination decreaseth, are in the foote of the Table, and the degrees of these signes, rise by the right side of the same. The disposition of the Table being vnderstoode, then to know what declination the Sunne hath in euery degree of the Zodiacke, you ought to know the true place of the Sunne (as in the chapter past is declared) for the day of the Declination which you desire to know, and the signe which the Sunne shall be found in that day, shall you seeke in the front or foote of the Table. And if it be in the front, you shall seeke the number of the degrees on the left side. And if it shall bee at the foote of the table, you shall seeke it on the right side. Then aboue or vnder the signe in the front of that degree of the said signe, you shall finde two numbers, whereof the first is of degrees, and the second

Signs	♈	♎	♉	♍	♊	♐	Signs.
°	°	°	°	°	°	°	°
0	0		11	30	20	12	30
1	0	14	11	51	20	25	29
2	0	48	12	12	20	37	28
3	1	12	12	33	20	49	27
4	1	36	12	53	21	0	26
5	2	0	13	13	21	11	25
6	2	23	13	33	21	22	24
7	2	47	13	53	21	32	23
8	3	11	14	13	21	42	22
9	3	35	14	32	21	51	21
10	3	58	14	51	22	0	20
11	4	22	15	10	22	9	19
12	4	45	15	28	22	17	18
13	5	9	15	47	22	25	17
14	5	32	16	5	22	32	16
15	5	55	16	23	22	39	15
16	6	19	16	40	22	46	14
17	6	42	16	57	22	52	13
18	7	5	17	14	23	57	12
19	7	28	17	31	23	3	11
20	7	50	17	47	23	8	10
21	8	13	18	3	23	12	9
22	8	35	18	19	23	15	8
23	8	58	18	34	23	19	7
24	9	20	18	49	23	22	6
25	9	42	19	4	23	24	5
26	10	4	19	18	23	26	4
27	10	26	19	32	23	28	3
28	10	47	19	46	23	29	2
29	11	9	19	59	23	30	1
30	11	30	20	12	23	30	0
Signs	♓	♍	♒	♌	♑	♋	Signs.

cond of minutes, and those degrees and minutes of declination, the sunne hath that day: suppose the place of the sun, were the 24. degree of ♈. the name of the signe standeth at the toppe of the table, therefore I seeke out the 24 degrée, on the left hand, and going from thence towards the right hand til I come right against ♈. I finde the declination to bee 9. degrées. 20'.

Againe, suppose the place of the sunne to bee 20. degrées of ♌. the name of the signe is at the foote of the table, therefore I seeke out the 20. degrée on the right hand, and going from thence towardes the left hand, till I come right against ♌. I finde the declination to be 14. degrées, 51'.

And this is vnderstood without hauing respect to the odde minutes aboue the degree, which the true place of the sunne hath.

But if you desire to verifie this more precisely, note the declination of that degrée, and of the degree following, and take

take the lesse from the more, and that which remaineth, shal be the difference of the declination from the one degrée to the other, of which difference ye shall take a part proportionally, as are the minutes of the place of the sun vnto 60. And this part of minutes must be added to the first declination of it, if the declination increase, or must be taken from it, if it decrease, and then that riseth thereof, shal be the precise declination for that signe, degrée and minute.

As for example, the 6. of July, 1609. I finde the place of the Sunne to be in 23. degrees, 4'3. of ♋. and to 23 degrees answeres 21. degrées, 3'2. of declination, and the declination of 24. degrées, is 21. degrées, 2'2. the difference is 1'0. then I say by the rule of 3. if 60. which is one degrée, giue 1'0. which is the difference of one degrées declination, what giueth 4'3. which are the odde minutes of the place of the Sunne, and the quotient shewes 7'. which because the declination decreaseth, I substract from 21. degrées, 3'2. the declination of 23. degrees iust, and there resteth 21. degrées, 2'5. for the declination of the sun, being in 23. degrées, 4'3. of ♋.

Againe this present yeare 1609. the 8. of November the Sunne is in 26. degrées, 1'1. of ♏, and to 26 degrées of ♏, answeres 19. degrees, 1'8. of declination, and to 27. degrées answere, 19. degrées, 3'2. of declination, the difference is 1'4. then I say, if 60. giue 14. what giues 11? the quotient is 2. which because the declination doth increase, I adde to 19 degrées, 1'8. it makes 19. degrees, 2'0. which is the declination of the day proposed.

This would suffice to those that would take the paine to calculate, but for that it is some what tedious especially for Sea-men to stand about to calculate at all times, when they shall haue occasion to vse the Sunnes declination, I haue here set downe a particular Table of the Sunnes declination for euery day of the moneth, for 4. seuerall yeares, according to the true place of the sunne formerly set downe.

CHAP. IIII.

Sheweth the Declination of the Sunne for euery month and day of the moneth throughout the yeare.

KNowing the great vse, necessity, and benefite, which doth abound to all Sea-faring men, by hauing knowledge what declination the Sunne makes, from the two Equinoctial points, viz. ♈ and ♎ towards eyther of the poles, that is to say, North or South, as also considering that the Table to the same purpose set downe before in the third chapter of the second part (because it is calculated, but onely for the degrées of each signe of the Zodiacke) is somewhat troublesome to find, because the true place of the Sunne is required, and then to worke by the rule of proportion, which euery one cannot doe, or at the least wise cannot at all times haue so much leasure, therefore I say, for the more easie and ready finding of the foresaide declination, I haue here gathered a regiment or table, according to the best & truest Calculaters, who in these dayes finde the greatest extention or declination of the Sunne, to be from the Equinoctiall towards eyther of the poles 23. degrées, 28. minuts, which greatest declination or distance, are called the tropical points of ♋ and ♑, vnto which points, the Sunne by his continuall mouing in the Zodiacke hauing attained, returneth againe to the Equinoctiall, descending by the same proportion of time, as he ascended, and so from thence to the contrary Tropicke, thereby making the beginnings of the foure principall times or quarters of the yeare, that is to say, Winter, the Spring, Summer & Autumne or Haruest, the chiefe vse of which tables are to finde the eleuation or height of the Poles aboue the Horizon, in any place whatsoeuer, being calculated for foure yeares, viz. the Leape yeare, & the first second and third after the Leape yeare, beginning at the yeare 1596. being leape yeare, & may serue at the least for 20. yeares without any notable error.

The vse and working whereof followeth after the saide Tables.

Ianuarie.

First			Second.			Third.			leap year		
1609			1610			1611			1612		
1613			1614			1615			1616		
1617			1918			1619			1620		
1621			1622			1623			1624		
1625			1626			1627			1628		
D	G	M	D	G	M	D	G	M	D	G	M
1	21	48	1	21	49	1	21	52	1	21	54
2	21	38	2	21	40	2	21	43	2	21	45
3	21	28	3	21	30	3	21	33	3	21	35
4	21	17	4	21	20	4	21	23	4	21	25
5	21	6	5	21	8	5	21	12	5	21	15
6	20	51	6	20	57	6	21	0	6	21	4
7	20	43	7	20	46	7	20	49	7	20	52
8	20	31	8	20	34	8	20	37	8	20	40
9	20	18	9	20	21	9	20	24	9	20	28
10	20	5	10	20	8	10	20	11	10	20	15
11	19	51	11	19	54	11	19	58	11	20	1
12	19	38	12	19	41	12	19	45	12	19	48
13	19	23	13	19	27	13	19	30	13	19	34
14	19	9	14	19	12	14	19	16	14	19	20
15	18	54	15	18	58	15	19	2	15	19	5
16	18	39	16	18	42	16	18	46	16	18	51
17	18	23	17	18	27	17	18	31	17	18	35
18	18	8	18	18	12	18	18	16	18	18	20
19	17	51	19	17	56	19	17	59	19	18	4
20	17	35	20	17	38	20	17	43	20	17	47
21	17	19	21	17	23	21	17	27	21	17	31
22	17	1	22	17	6	22	17	10	22	17	14
23	16	44	23	16	48	23	16	52	23	16	57
24	16	26	24	16	31	24	16	35	24	16	39
25	16	29	25	16	13	25	16	18	25	16	22
26	15	50	26	15	55	26	15	59	26	16	4
27	15	31	27	15	36	27	15	41	27	15	45
28	15	12	29	15	17	28	15	22	28	15	26
29	14	54	29	14	59	29	15	4	29	15	8
30	14	34	30	14	40	30	14	44	30	14	49
31	14	15	31	14	20	31	14	25	31	14	30

South Declination. | Sourh Declination. | South Declination.

Februarie.

First			Second.			Third.			leap year		
1609			1610			1611			1612		
1613			1614			1615			1616		
1617			1918			6 19			1620		
1621			1622			1623			1624		
1625			1626			1627			1628		
D	G	M	D	G	M	D	G	M	D	G	M
1	13	55	1	14	0	1	14	6	1	14	10
2	13	35	2	13	40	2	13	45	2	13	50
3	13	14	3	13	20	3	13	25	3	13	30
4	12	54	4	13	0	4	13	4	4	13	10
5	12	34	5	12	40	5	12	44	5	12	50
6	12	13	6	12	20	6	12	24	6	12	29
7	11	52	7	11	58	7	12	3	7	12	8
8	11	31	8	11	36	8	11	42	8	11	47
9	11	10	9	11	15	9	11	21	9	11	26
10	10	48	10	10	53	10	11	0	10	11	5
11	10	26	11	10	31	11	10	38	11	10	43
12	10	4	12	10	10	12	10	16	12	10	21
13	9	42	13	9	48	13	9	54	13	9	59
14	9	20	14	9	26	14	9	32	14	9	37
15	8	58	15	9	4	15	9	10	15	9	15
16	8	30	16	8	41	16	8	48	16	8	53
17	8	13	17	8	18	17	8	24	17	8	30
18	7	50	18	7	56	18	8	2	18	8	7
19	7	28	19	7	33	19	7	39	19	7	44
20	7	5	20	7	11	20	7	17	20	7	22
21	6	42	21	6	48	21	6	54	21	6	59
22	6	19	22	6	25	22	6	31	22	6	36
23	5	55	23	6	2	23	6	8	23	6	13
24	5	32	24	5	38	24	5	44	24	5	49
25	5	9	25	5	15	25	5	21	25	5	26
26	4	45	26	4	52	26	4	58	26	5	3
27	4	22	27	4	28	27	4	34	27	4	39
28	3	58	28	4	5	28	4	11	28	4	16
29										3	52

South Declination. South Declination. South Declination.

March.

First.			Second.			Third.			leap year		
1609			1610			1611			1612		
1613			1614			1615			1616		
1617			1618			1619			1620		
1621			1622			1623			1624		
1625			1626			1627			1628		
D	G	M	D	G	M	D	G	M	D	G	M
1	3	35	1	3	41	1	3	47	1	3	30
2	3	11	2	3	18	2	3	24	2	3	6
3	2	47	3	2	54	3	3	0	3	2	42
4	2	23	4	2	30	4	2	36	4	2	18
5	2	0	5	2	6	5	2	12	5	1	55
6	1	36	6	1	43	6	1	49	6	1	30
7	1	13	7	1	18	7	1	25	7	1	7
8	0	50	8	0	56	8	1	1	8	0	43
9	0	26	9	0	32	9	0	38	9	0	21
10	0	2	10	0	8	10	0	14	10	0	0
11	0	22	11	0	16	11	0	10	11	0	28
12	0	45	12	0	39	12	0	34	12	0	52
13	1	9	13	1	3	13	0	57	13	1	15
14	1	32	14	1	27	14	1	21	14	1	38
15	1	57	15	1	50	15	1	44	15	2	2
16	2	19	16	2	13	16	2	8	16	2	25
17	2	42	17	2	36	17	2	31	17	2	49
18	3	6	18	3	0	18	2	54	18	3	13
19	3	30	19	3	24	19	3	18	19	3	36
20	3	53	20	3	48	20	3	42	20	3	59
21	4	16	21	4	10	21	4	4	21	4	22
22	4	39	22	4	33	22	4	28	22	4	45
23	5	2	23	4	56	23	4	50	23	5	9
24	5	26	24	5	19	24	5	14	24	5	32
25	5	48	25	5	42	25	5	37	25	5	54
26	6	11	26	6	5	26	5	59	26	6	17
27	6	34	27	6	28	27	6	23	27	6	40
28	6	57	28	6	50	28	6	45	28	7	3
29	7	19	29	7	13	29	7	8	29	7	27
30	7	42	30	7	36	30	7	30	30	7	47
31	8	3	31	7	57	31	7	51	31	8	9

South Declination. Equi- North Declination.

South Declination. noctial. North Declination.

North Declination. all. South Declination.

April.

First			Second.			Third.			leap year		
1609			1610			1611			1612		
1613			1614			1615			1616		
1617			1918			1619			1620		
1621			1622			1623			1624		
1625			1626			1627			1628		
D	G	M	D	G	M	D	G	M	D	G	M
1	8	25	1	8	19	1	8	14	1	8	31
2	8	47	2	8	41	2	8	35	2	8	53
3	9	9	3	9	3	3	8	58	3	9	15
4	9	31	4	9	25	4	9	20	4	9	36
5	9	52	5	9	46	5	9	42	5	9	58
6	10	14	6	10	8	6	10	3	6	10	19
7	10	35	7	10	30	7	10	24	7	10	40
8	10	55	8	10	50	8	10	45	8	11	1
9	11	16	9	11	11	9	11	6	9	11	22
10	11	37	10	11	32	10	11	27	10	11	43
11	11	57	11	11	52	11	11	47	11	12	3
12	12	18	12	12	12	12	12	7	12	12	23
13	12	38	13	12	33	13	12	28	13	12	43
14	12	57	14	12	53	14	12	47	14	13	2
15	13	17	15	13	12	15	13	7	15	13	21
16	13	36	16	13	32	16	13	26	16	13	41
17	13	55	17	13	50	17	13	46	17	14	0
18	14	15	18	14	10	18	14	5	18	14	19
19	14	33	19	14	29	19	14	23	19	14	37
20	14	51	20	14	46	20	14	42	20	14	56
21	15	10	21	15	5	21	15	0	21	15	14
22	15	27	22	15	23	22	15	19	22	15	32
23	15	46	23	15	41	23	15	36	23	15	50
24	16	3	24	15	59	24	15	54	24	16	7
25	16	20	25	16	16	25	16	11	25	16	25
26	16	37	26	16	33	26	16	28	26	16	41
27	16	53	27	16	49	27	16	45	27	16	57
28	17	10	29	17	5	28	17	1	28	17	14
29	17	26	29	17	22	29	17	18	29	17	30
30	17	41	30	17	38	30	17	34	30	17	46

North Declination.

North Declination.

North Declination.

May.

North Declination.

First. 1609 1613 1617 1621 1625			Second. 1610 1614 1618 1622 1626			Third. 1611 1615 1619 1623 1627			leap year 1612 1616 1620 1624 1628		
D	G	M	D	G	M	D	G	M	D	G	M
1	17	57	1	17	54	1	17	50	1	18	2
2	18	13	2	18	9	2	18	5	2	18	17
3	18	28	3	18	25	3	18	21	3	18	31
4	18	42	4	18	39	4	18	35	4	18	46
5	18	56	5	18	53	5	18	49	5	19	0
6	19	11	6	19	7	6	19	4	6	19	14
7	19	24	7	19	21	7	19	18	7	19	27
8	19	38	8	19	34	8	19	31	8	19	41
9	19	51	9	19	47	9	19	44	9	19	54
10	20	3	10	20	0	10	19	57	10	20	6
11	20	15	11	20	12	11	20	9	11	20	18
12	20	28	12	20	25	12	20	22	12	20	31
13	20	39	13	20	37	13	20	34	13	20	42
14	20	51	14	20	48	14	20	45	14	20	53
15	21	1	15	20	59	15	20	56	15	21	4
16	21	12	16	21	10	16	21	7	16	21	14
17	21	22	17	21	20	17	21	17	17	21	25
18	21	32	18	21	30	18	21	27	18	21	34
19	21	41	19	21	39	19	21	37	19	21	44
20	21	50	20	21	48	20	21	46	20	21	52
21	21	59	21	21	56	21	21	54	21	22	1
22	22	7	22	22	5	22	22	3	22	22	9
23	22	15	23	22	13	23	22	11	23	22	17
24	22	22	24	22	21	24	22	19	24	22	25
25	22	29	25	22	28	25	22	26	25	22	31
26	22	36	26	22	35	26	22	33	26	22	38
27	22	42	27	22	41	27	22	40	27	22	45
28	22	49	28	22	48	28	22	46	28	22	50
29	22	55	29	22	53	29	22	52	29	22	55
30	22	59	30	22	58	30	22	57	30	23	0
31	23	65	31	23	4	31	23	3	31	23	5

5-5-

Iune.

First.				Second.				Third.				leap yea			
1609				1610				1611				1612			
1613				1614				1615				1616			
1617				1618				1619				1620			
1621				1622				1623				1924			
1625				1626				1627				1628			
D	G	M		D	G	M		D	G	M		D	G	M	
1	23	9		1	23	8		1	23	6		1	23	9	
2	23	13		2	23	12		2	23	11		2	23	14	
3	23	16	North	3	23	15	North	3	23	14	North	3	23	17	North
4	23	20		4	23	19		4	23	18		4	23	20	
5	23	23		5	23	22		5	23	22		5	23	23	
6	23	24		6	23	24		6	23	23		6	23	25	
7	23	26	tropick	7	23	26	tropick	7	23	25	tropick	7	23	27	tropick
8	23	28		8	23	28		8	23	27		8	23	28	
9	23	29	Declination.	9	23	29	Declination.	9	23	29	Declination.	9	23	29	Declination.
10	23	30		10	23	30		10	23	30		10	23	30	
11	23	30		11	23	30		11	23	30		11	23	30	
12	23	30		12	23	30		12	23	30		12	23	30	
13	23	29		13	23	29		13	23	30		13	23	29	
14	23	28		14	23	29		14	23	29		14	23	28	
15	23	27		15	23	28		15	23	28		15	23	26	
16	23	25		16	23	26		16	23	26		16	23	24	
17	23	23		17	23	24		17	23	24		17	23	22	
18	23	20		18	23	21		18	23	22		18	23	19	
19	23	17		19	23	18		19	23	19		19	23	16	
20	23	13		20	23	14		20	23	15		20	23	13	
21	23	10		21	23	11		21	23	12		21	23	8	
22	23	6		22	23	6		22	23	7		22	23	4	
23	23	1		23	23	3		23	23	3		23	23	59	
24	22	55		24	22	57		24	22	58		24	22	54	
25	22	51		25	22	52		25	22	53		25	22	49	
26	22	45		26	22	46		26	22	48		26	22	43	
27	22	38		27	22	40		27	22	42		27	22	37	
28	22	31		28	22	34		28	22	3		28	22	30	
29	22	25		29	22	27		29	22	28		29	22	23	
30	22	17		30	22	19		30	22	21		30	22	15	

Iuly.

First.	Second.	Third.	leap year
1609	1610	1611	1612
1613	1614	1615	1616
1617	1618	1619	1620
1621	1622	1623	1624
1625	1626	1627	1628

D	G	M	North Declination.	D	G	M	North Declination.	D	G	M	North Declination	D	G	M
1	22	9		1	22	11		1	22	13		1	22	8
2	22	1		2	22	3		2	22	5		2	21	59
3	21	52		3	21	55		3	21	56		3	21	50
4	21	44		4	21	46		4	21	48		4	21	41
5	21	34		5	21	37		5	21	39		5	21	32
6	21	25		6	21	27		6	21	29		6	21	22
7	21	15		7	21	18		7	21	20		7	21	12
8	21	4		8	21	7		8	21	9		8	21	1
9	20	54		9	20	56		9	20	59		9	20	51
10	20	43		10	20	46		10	20	48		10	20	39
11	20	31		11	20	34		11	20	37		11	20	28
12	20	19		12	20	23		12	20	25		12	20	16
13	20	7		13	20	10		13	20	13		13	20	3
14	19	54		14	19	57		14	20	0		14	19	51
15	19	42		15	19	45		15	19	48		15	19	38
16	19	28		16	19	32		16	19	35		16	19	25
17	19	15		17	19	18		17	19	21		17	19	11
18	19	2		18	19	4		18	19	8		18	18	58
19	18	47		19	18	50		19	18	53		19	18	43
20	18	32		20	18	36		20	18	39		20	18	29
21	18	18		21	18	22		21	18	25		21	18	14
22	18	3		22	18	6		22	18	10		22	17	59
23	17	47		23	17	51		23	17	55		23	17	44
24	17	32		24	17	36		24	17	40		24	17	29
25	17	16		25	17	20		25	17	25		25	17	12
26	17	0		26	17	5		26	17	8		26	16	56
27	16	43		27	16	47		27	16	52		27	16	39
28	16	27		28	16	31		28	16	35		28	16	23
29	16	10		29	16	15		29	16	19		29	16	5
30	15	53		30	15	57		30	16	2		30	15	48
31	15	34		31	15	40		31	15	44		31	15	30

August.

North Declination.

First. 1609 1613 1617 1621 1625			Second. 1610 1614 1618 1622 1626			Third. 1611 1615 1619 1623 1627			leap year 1612 1616 1620 1924 1628		
D	G	M	D	G	M	D	G	M	D	G	M
1	15	17	1	15	22	1	15	26	1	15	13
2	14	59	2	15	4	2	15	8	2	14	54
3	14	41	3	14	46	3	14	50	3	14	36
4	14	23	4	14	27	4	14	32	4	14	18
5	14	4	5	14	9	5	14	13	5	13	59
6	13	45	6	13	49	6	13	54	6	13	40
7	13	25	7	13	30	7	13	35	7	13	21
8	13	6	8	13	11	8	13	16	8	13	1
9	12	47	9	12	52	9	12	57	9	12	42
10	12	28	10	12	32	10	12	37	10	12	23
11	12	7	11	12	12	11	12	17	11	12	2
12	11	47	12	11	52	12	11	57	12	11	42
13	11	27	13	11	31	13	11	36	13	11	21
14	11	6	14	11	11	14	11	16	14	11	1
15	10	45	15	10	49	15	10	55	15	10	39
16	10	25	16	10	29	16	10	35	16	10	19
17	10	4	17	10	8	17	10	14	17	9	58
18	9	42	18	9	47	18	9	53	18	9	36
19	9	20	19	9	29	19	9	31	19	9	14
20	8	59	20	9	4	20	9	10	20	8	54
21	8	37	21	8	42	21	8	49	21	8	32
22	8	16	22	8	21	22	8	27	22	8	10
23	7	53	23	7	56	23	8	5	23	7	48
24	7	32	24	7	37	24	7	43	24	7	26
25	7	9	25	7	15	25	7	21	25	7	4
26	6	47	26	6	53	26	6	59	26	6	42
27	6	25	27	6	30	27	6	36	27	6	19
28	6	2	28	6	7	28	6	14	28	5	55
29	5	39	29	5	45	29	5	51	29	5	33
30	5	16	30	5	22	30	5	28	30	5	11
31	4	52	31	5	0	31	5	6	31	4	48

September.

First.			Second.			Third.			leap year
1609			1610			1611			1612
1613			1614			1615			1616
1617			1618			1619			1620
1621			1622			1623			1624
1625			1626			1627			1628
D	G	M	D	G	M	D	G	M	D	G	M
1	4	30	1	4	37	1	4	43	1	4	25
2	4	8	2	4	14	2	4	20	2	4	2
3	3	45	3	3	51	3	3	57	3	3	40
4	3	22	4	3	28	4	3	34	4	3	16
5	2	59	5	3	5	5	3	11	5	2	53
6	2	35	6	2	42	6	2	47	6	2	29
7	2	12	7	2	18	7	2	23	7	2	7
8	1	49	8	1	56	8	2	1	8	1	42
9	1	25	9	1	31	9	1	37	9	1	20
10	1	2	10	1	9	10	1	14	10	0	57
11	0	39	11	0	48	11	0	51	11	0	33
12	0	15	12	0	21	12	0	27	12	0	9
13	0	8	13	0	2	13	0	4	13	0	14
14	0	32	14	0	26	14	0	19	14	0	38
15	0	55	15	0	49	15	0	43	15	1	1
16	1	19	16	1	12	16	1	7	16	1	25
17	1	42	17	1	35	17	1	30	17	1	47
18	2	6	18	2	0	18	1	53	18	2	12
19	2	29	19	2	23	19	2	17	19	2	35
20	2	52	20	2	47	20	2	40	20	2	59
21	3	16	21	3	11	21	3	3	21	3	22
22	3	40	22	3	34	22	3	27	22	3	45
23	4	2	23	3	56	23	3	51	23	4	8
24	4	26	24	4	20	24	4	13	24	4	32
25	4	49	25	4	43	25	4	37	25	4	55
26	5	13	26	5	7	26	5	0	26	5	18
27	5	35	27	5	29	27	5	23	27	5	41
28	5	58	28	5	52	28	5	46	28	6	4
29	6	22	29	6	25	29	6	9	29	6	27
30	6	45	30	6	39	30	6	33	30	6	50

North Declination. Equi- South Declination.

North Declination. noctiall. South Declination.

North Declination. South Declination.

October.

First			Second.			Third.			leap year		
1609			1610			1611			1612		
1613			1614			1615			1616		
1617			1618			1619			1620		
1621			1622			1623			1624		
1625			1626			1627			1628		
D	G	M	D	G	M	D	G	M	D	G	M
1	7	7	1	7	2	1	6	56	1	7	13
2	7	30	2	7	25	2	7	19	2	7	36
3	7	52	3	7	47	3	7	41	3	7	58
4	8	15	4	8	9	4	8	3	4	8	20
5	8	37	5	8	32	5	8	26	5	8	42
6	8	59	6	8	53	6	8	48	6	9	5
7	9	21	7	9	16	7	9	10	7	9	27
8	9	43	8	9	38	8	9	32	8	9	49
9	10	5	9	10	0	9	9	54	9	10	11
10	10	27	10	10	22	10	10	16	10	10	33
11	10	48	11	10	43	11	10	38	11	10	54
12	11	10	12	11	4	12	10	59	12	11	16
13	11	31	13	11	36	13	11	20	13	11	36
14	11	52	14	11	47	14	11	41	14	11	57
15	12	13	15	12	8	15	12	2	15	12	18
16	12	34	16	12	29	16	12	23	16	12	39
17	12	54	17	12	50	17	12	44	17	12	59
18	13	14	18	13	10	18	13	4	18	13	19
19	13	34	19	13	30	19	13	24	19	13	39
20	13	54	20	13	50	20	13	44	20	14	0
21	14	14	21	14	10	21	14	4	21	14	20
22	14	33	22	14	29	22	14	24	22	14	39
23	14	52	23	14	48	23	14	44	23	14	58
24	15	12	24	15	9	24	15	2	24	15	17
25	15	29	25	15	25	25	15	20	25	15	35
26	15	48	26	15	43	26	15	38	26	15	52
27	16	6	27	16	2	27	15	57	27	16	12
28	16	25	28	16	20	28	16	15	28	16	30
29	16	42	29	16	38	29	16	33	29	16	46
30	16	59	30	16	55	30	16	50	30	17	4
31	17	16	31	17	12	31	17	7	31	17	21

South Declination.

South Declination.

South Declination.

Nouember.

First.			Second.			Third.			leap year		
1609			1610			1611			1612		
1613			1614			1615			1616		
1617			1618			1619			1620		
1621			1622			1623			1624		
1625			1626			1627			1628		
D	G	M	D	G	M	D	G	M	D	G	M
1	17	33	1	17	29	1	17	24	1	17	37
2	17	49	2	17	45	2	17	41	2	17	53
3	18	5	3	18	1	3	17	57	3	18	9
4	18	21	4	18	17	4	18	13	4	18	25
5	18	36	5	18	33	5	18	29	5	18	40
6	18	51	6	18	47	6	18	44	6	18	55
7	19	6	7	19	2	7	18	59	7	19	10
8	19	20	8	19	17	8	19	14	8	19	24
9	19	35	9	19	31	9	19	28	9	19	38
10	19	49	10	19	45	10	19	42	10	19	52
11	20	2	11	19	59	11	19	56	11	20	5
12	20	15	12	20	12	12	20	9	12	20	18
13	20	28	13	20	25	13	20	22	13	20	31
14	20	40	14	20	37	14	20	34	14	20	43
15	20	52	15	20	49	15	20	46	15	20	55
16	21	3	16	21	0	16	20	58	16	21	6
17	21	14	17	21	11	17	21	9	17	21	17
18	21	25	18	21	22	18	21	20	18	21	28
19	21	35	19	21	33	19	21	30	19	21	38
20	21	45	20	21	43	20	21	40	20	21	48
21	21	54	21	21	52	21	21	50	21	21	57
22	22	3	22	22	1	22	21	59	22	22	6
23	22	13	23	22	10	23	22	8	23	22	14
24	22	20	24	22	18	24	22	17	24	22	22
25	22	28	25	22	26	25	22	25	25	22	30
26	22	35	26	22	33	26	22	32	26	22	37
27	22	42	27	22	40	27	22	39	27	22	44
28	22	49	28	22	47	28	22	46	28	22	51
29	22	55	29	22	52	29	22	52	29	22	57
30	23	0	30	22	58	30	22	57	30	23	2
						31					

South Declination. South Declination. South Declination

December.

South Declination.

First.			Second.			Third.			leap year		
1609			1610			1611			1612		
1613			1614			1615			1616		
1617			1618			1619			1620		
1621			1622			1623			1924		
1625			1626			1627			1628		
D	G	M	D	G	M	D	G	M	D	G	M
1	23	5	1	23	4	1	23	3	1	23	6
2	23	9	2	23	8	2	23	7	2	23	10
3	23	14	3	23	13	3	23	12	3	23	15
4	23	17	4	23	16	4	23	15	4	23	19
5	23	21	5	23	20	5	23	19	5	23	22
6	23	23	6	23	23	6	23	22	6	23	24
7	23	25	7	23	25	7	23	24	7	23	26
8	23	27	8	23	27	8	23	26	8	23	28
9	23	29	9	23	29	9	23	28	9	23	29
10	23	30	10	23	30	10	23	29	10	23	30
11	23	30	11	23	30	11	23	30	11	23	30
12	23	30	12	23	30	12	23	30	12	23	30
13	23	29	13	23	30	13	23	30	13	23	29
14	23	28	14	23	29	14	23	29	14	23	28
15	23	26	15	23	27	15	23	28	15	23	26
16	23	24	16	23	25	16	23	26	16	23	24
17	23	22	17	23	23	17	23	24	17	23	22
18	23	19	18	23	20	18	23	21	18	23	19
19	23	15	19	23	17	19	23	18	19	23	15
20	23	11	20	23	13	20	23	14	20	23	11
21	23	7	21	23	9	21	23	10	21	23	8
22	22	2	22	23	4	22	23	5	22	23	2
23	22	57	23	22	59	23	23	0	23	22	56
24	22	52	24	22	53	24	22	54	24	22	50
25	22	46	25	22	48	25	22	49	25	22	44
26	22	39	26	22	41	26	22	43	26	22	37
27	22	32	27	22	33	27	22	35	27	22	30
28	22	24	28	22	26	28	22	28	28	22	23
29	22	16	29	22	19	29	22	21	29	22	14
30	22	8	30	22	10	30	22	12	30	22	6
31	21	59	31	22	1	31	22	4	31	21	57

tropick

South Declination.

tropick

South Declination.

tropick

How to vse the Sunnes declination, to know the Pole Eleuation.

FIrst consider, whether the Sunne hath north or south declination, which you shall know by the former tables, & if the Sunne hath North declination, substract the meridian altitude thereof from 90. and to the rest adde the declination for the day proposed, but if the Sun hath south declination, adde the declination to the meridian altitude, the same substract from 90. the rest is the Eleuation of the Pole. Example: at London, the 16. of Aprill, 1596. the declination is North, 13. degrees, 25. minutes, and the height of the sunne vpon the meridian, is 51. degrees, 43. minutes, which taken from 90. rests 38. degrees, 17. minutes, the same added to the declination, 13. degrées, 25. minutes, makes 51. degrées, 42. minutes, and so much is the height of the Pole. Againe, the 21. of Ianuarie, the Sunne hath South declination, 17. degrées 36. minutes, and I find the Meridian Altitude to bee 20. degrées, 42. minutes, which added together, makes 38. degrees, 18. minutes, the same substract from 90. degrees, rests 51. degrees, 42. minutes, the eleuation aforesaid. But this is vnderstood, when you know certainely on which side of the Equinoctiall you are, to know which, do thus: if the sun cast his shadow that way that he is from the equinoctial, he is betwixt you & it, & if the sun hauing north declination, giue a south shadow, or south declination, giue a north shadow, then is the equator betwixt you & the sunne, or you in the equator, or you betwixt the Equator & the sun to know which, adde the declination to the meridian altitude, if it be lesse, then 90. so much as wanteth of 90. is your distance frō the equator, on that side which the shadow strykeh, but if it amount to 90. then are you vnder the equator, if more then 90. so much as is the ouerplus are you from the equator towards the sun, and then are you betwixt the equator and the sun, also if the meridian altitude be equall with your Zenith, so much as is the declination of the sunne, are you distant from the equator, on that side wherein the sun is, but if the sun haue no declination, then are you vnder the Equinoctiall.

CHAP.

CHAP. V.

Of the entrance of the Sunne into the twelue Signes, and of the Equinoctials, and Solstitials, which diuide the foure times of the yeare.

OF that it is said in the Chapter before, it followeth that the sunne entring into the foure principall signes, causeth the foure times of the yeare. For entring into Aries it changeth the time to vs from winter to the Spring-time, and entring into Cancer, it changeth the time from spring to summer. And entring into Libra, from Summer to Autumme. Likewise entring into Capricorne, it changeth from Autumne to Winter. So that when to vs that be on the part of the North, is summer, then is it winter to them that are on the South part. Or contrariwise being sommer to them on the South, it is winter to them on the North. The entrance of the Sunne into these signes, and all other of the Zodiacke hath not beene euer at one selfe same time of the yeare. The cause of this is, that the latine yeere is not equall with the moving of the sunne in the Zodiacke, as shall be saide in the 7. chapter, where wee will entrate of the yeare. In the time that Christ our Redéemer was borne, were the Equinoctials, the one at the eight of the Kalends of April, and the other at fiue of the Kalends of October: so that they had the Equinoctiall of the spring, at the 25. of March, and the Equinoctiall of Autumne, at the 27 of September, as writeth Iohn Baptist Capuano vpon the second Chapter of the Spheare of Iohan de sacro Bosco. They iudged then the Solstitialles, as that of the Summer, at the eight day of the Kalends of July which is the 24: of June, the other of the Winter, they iudged at the eight day of the Kalends of January, which is the 25, of December. And here will not I omit to say how in those times, at these foure dayes (that is to mean, in the two Solstitials, and two Equinoctialls) were celebrated,

ted, or did chance foure miraculous thinges in the worlde. For in the spring Equinoctiall, which was at the xxb. of March, the Sonne of God was incarnate, and afterward borne of the Virgine Marie in the Solstitiall of Winter, which was at the xxb. of December. In the Equinoctial of Autumne. which was the xxbii. of September, was conceiued blessed Iohn Baptist, the cryer and precursour of Christ, and was borne in the Summer Solstitiall, that was the xxiiii. of June. And this is the first Moneth whereof Saint Luke speaketh in the Gospell. Which thing also Iohn Chrysostome doth confesse, saying that Saint Iohn was borne when the dayes beganne to decrease, and our Lord when they beganne to increase. And it may certainely seeme worthy to bee had in memory, that in the said Equinoctiall of the Spring, Christ suffered, Adam was created, and lost the estate of Innocency, Abel was slaine, Melchisedech offered bread and wine: Isaacke by Abraham was brought to be sacrificed: Iohn Baptist was beheaded at Micherunta, Peter deliuered out of prison, S. Iames beheaded by Herod, the good Theefe enioyed Paradise, and the bodies of many Saints rose with Christ: and who so further desireth more precisely to know the entrance of the Sunne into Aries, and into the other principall signes, shall in the third part of this worke in the eight Chapter, find rules which shall bring him to the knowledge thereof. But to returne to our time, I say, this present yeare of 1609 the Sunne entreth

Into ♈ the 10. of March two howres after noone:
Into ♉ the 10. of April, seuen howres before noone.
Into ♊ the 11 of May, fiue howres before noone.
Into ♋ the 11 of June, fowre howres after noone.
Into ♌ the 13 of of July, at two a clocke in the morning:
Into ♍ the 13. of August, fowre howres before noone:
Into ♎ the 13 of September, 8 howres before noone:
Into ♏ the 13 of October, one howre before noone.
Into ♐ the 12 of Nouember, fiue howres before noone,

Into ♑ the 11. of December, 5. howres after noone.
Into ♒ the 9. of January, 9. howres after noone.
Into ♓ the 8. of Februarie, 56. minutes after noone.

And for to know the certaine time of the Sunnes entrance into each signe, for any yeare hereafter, you must adde for euery yeare fiue howres, and 49. minutes, which is the ouerplus that each yeare hath, so that in foure yeares it comes to one naturall day, which is added to February, making it thereby to haue 29. dayes, which in other yeares hath but 28, and then pulling one day backe againe from the yeare 1596, and to that which remaineth, adde to the yeare 1597, 5. howres, 49. minutes, and as much more euery yeare following, which shall be a certaine rule for euer.

Now you must note that the degrées and minutes, which are here noted, are properly for the City of London, whose Longitudes are 25. degrées, 50'. and if you desire to apply them for places more East ward, then for euery 15. degrées difference in Longitude, you must adde one howre, and if for places more West ward, for euery 15 degrées difference of longitude, you must substract one howre by reason of the Sunnes rapt mouing from the East to the West, for it is certaine that when with vs in London it is twelue of the clocke, to them of Meissen, which is 15. degrées to the east ward of vs, it is one of the Clocke, and to them of Forteuentura, which are 15. degrées to the West of vs, it is but 11 of the Clocke.

Now that we haue Rules to know the entrance of the Sunne into the xii. signes, thereby may wee also know his entrance into the foure Cardinall or principall signes, which are they that determine and end the Equinoctials and Solstitialls, whereby are caused the foure times of the yeare. And for asmuch as the generall change of times, is by reason of the Sunne, who by his comming neare, warmeth: by his remayning, dryeth: with his departure, cooleth: and by his long tarrying away, causeth moistnesse, wee will shew the qualities of the principall windes, elements, regi-

ons,

ons, humours, and ages, in one briefe Table, and then consequently in an other will wee describe the beginning, middest and end of the foure times of the yeare, aswel in the monethes, as in the heauenly signes.

The Table of the qualities of the Elements.

Qualities	hot & drie	hot & moist	cold & moist	Cold & drie
parts of ỹ yere	Summer	Spring	Winter	Autumne.
principall winds	East	South	West	North
Elements	Fire	Ayre	Water.	Earth
Regions	East	South	West	North
4. Humours	Choler	Bloud	Flegme	melãcholy
4 Ages.	Youth	Mans state	Aged	Age

The table of the foure times of the yeare.

Tymes	Beginning.	Middest	End
Spring	March Aries	Aprll Taurus	May Gem.
Sommer	June Cancer	July Leo	Aug. Virg.
Autumne	Septemb. Libra	Octob. Scorp.	Nouẽ. Gem.
Winter	Decem. Capric.	Janu. Aquar.	Febr. Pisces

CHAP. V.
Of the Moone and of her Motions and properties.

IN the Chapters past of this second part, we haue entreated of the Sunne, and of his motions & effects, as the most noble and principall Luminary. In this present chapter wée will entreat of the Moone, which is the second Luminarie, although in the order of the heauens she is the first, and nearest vnto vs of all other Planets or starres: The Moone therefore is a round body, of heauenly substance, solide and darke in respect of the Sunne, hauing no proper light of her

owne, but is apt to receiue light. Shee is mooued from the West into the East, according to the order of the signes, euery day thirteene degrees, little more or lesse, and somewhat more then ten minutes, by the proper motion of the Heauen or Spheare, vpon the Axes and Poles of the Zodiacke, I say more or lesse, because that ouer and beside the mouing of her deferent or circle, which is moued euery day the aforesaid thirteene degrées, and ten minutes, almost eleuen, she hath an Epicicle, where the Moone is fixed: at the motion whereof, sometimes shee is moued more swiftly, and sometimes more slowly: Neuertheless, according to her selfe motion, shee maketh her course in 27 dayes & almost 8 howres, and hauing no light of her owne, she is lightned of the sunne, as manifestly appeareth hereby, that being in Coniunction with the sunne, or nére vnto him, wée sée her not lightened, because the light which she then receiueth, is onely her vppermost or highest part, whereby shee directly beholdeth the sunne, forasmuch as he is in the fourth heauen, and shee in the first. And departing from the sunne by her proper mooving, the sume remaineth on the West part. Then toward that part wee beginne to see a little of the part of the Moone lightned, and so more and more by little and little as she departeth further from the sunne. And at this time she hath her horns or corners toward the East, because the sunne is in the West: during this time also, shee is said to encreale, or that she goeth increasing vnto the opposition which we see by the part of her, which the sunne directly beholdeth. And so we sée her altogether lightned, and call it the full Moone. Then passing from the Opposition, she commeth nearer the sun by little and little, being darkened and hid from vs, and lightned onely by her highest part, and this time is called the decreasing or wane of the Moone. Then also hath shee her hornes toward the West, because the sunne is in the East; and this vntill shee turne againe in coniunction with the sunne, and that we sée her not lightned at all.

The

The Moone is lesse then the starres or other planets except Mercurie, and lesse then the earth. And if any shall affirme the contrary, saying that it is written in Genesis, that God made two great lights, the greatest to giue light to the day, and the lesse to lighten the night (as Dauid also affirmeth.) To this I answere, that the Moone beeing nearest vnto the earth, appeareth vnto vs greater then shee should doe, if shee were further distant from vs. And although shee bee great of light (receyued as we haue said) and bigge of body, yet is shee not great in respect of the other Starrs. And therefore the wordes of Genesis aforesaid may be vnderstood to be spoken in such manner and phrase as holy Scripture often vseth, to humble and apply it selfe to the weakenesse of our vnderstanding, and grosenesse of our senses.

CHAP. VI.

Of the Coniunctions and Oppositions of the Sunne and the Moone.

The Sunne and the Moone are mooued vnder the Zodiacke with diuers Motions. The Moone with a swifter Motion then the Sunne followeth him, ouertaketh him and goeth before him, vntill shee place her selfe in Diameter with him. And when shee hath thus ouertaken him, so that they are both in one selfe same degree of the Zodiacke, then is the Coniunction. Then departing from him, and beeing in equall Degrees of the Signes opposite according to the Diameter, is the Opposition. To know the time of these Coniunctions and Oppositions is very profitable and necessarie for Mariners. These times may be knowne in two manners, One way, by the Ephemerides or Almanacke, or other tables, or Lunarie Instrumentes: And by these meanes is known precisely the day, houre, and

minute of the coniunction and oppoſition. It may likewiſe be knowne by the rules of computation, which are the rules that are knowne by memorie, although not preciſely, as by the bookes aforeſaid. And here is to be vnderſtoode, that from one coniunction to another, according to the halfe mouings of the Sunne and the Moone, there paſſeth 29. daies twelue howres, and forty foure minutes. And conſequently from coniunction to oppoſition, and from oppoſition to coniunction, the halfe thereof, which is foureteene dayes, eighteene howres, and twenty two minutes. To know theſe coniunctions by rules of computation, is preſuppoſed to know the golden number, and by it, the concurrent or Epact.

The golden number, is the number of nineteen yeares. In which time the coniunctions of the Sunne and the Moone make all their varieties in the times of euery yeare: ſo that if the coniunction were the eighteenth day of March in this yeare 1609. from this yeare in the nineteenth year following, which ſhall be in the yeare 1628, the coniunction ſhall returne to be at the eighteenth day of March. It was firſt called the Golden number by the Egyptians, who firſt found the vſe thereof, and ſent it to Rome written in golden Letters. To find this number, it is needfull to know his rotes, which is this. In the yeare that Chriſt our Lord and Redeemer was borne (whereby we make this account) the golden number was the number of one, which was the yeare of the roote or beginning: and the firſt yeare of the birth of Chriſt, was two of the golden number: ſo that ioyning to the yeares of our Lord, one of the roote or beginning, and from all take away the nineteene, then the reſt ſhall be the Golden number. And if you deſire to make computation by a nearer rote, take for the rote the yeare of 1500, when nineteene was the golden number, and in the yeare of 1501. did beginne one of the golden number, and ſo conſequently, euer taking away the nineteene.

This preſent yeare 1609. we haue 14. of the Gol-

den

den number, and in the yeare of 1610, wee shall haue 15.

The golden number being knowne, it is necessarie for this computation of the Moone to know the concurrent: The concurrent of euery yeare, is the number of the dayes passed of the coniunction of the Moon, at the beginning of March. And these grow of the difference of the Solar yeare to the Lunar: As the Lunar yeare hath 354. dayes, and the Solar yeare 365, so hauing euery yeare eleuen dayes of difference, which are added euery yeare vntill they come to the number of thirty, and passing thirty, those that doe passe are of the concurrent.

The number of the concurrent of euery yeare, is found in this manner.

And the better to beare it in memory, you must imagine three places, and these commonly are assigned on the thumbe. As the first place at the roote of the thumbe, the second in the middle ioynt thereof, and the third and last in the toppe of the thumbe. Then in the first place put ten, in the second twentie, and in the third thirty. Then by the order of these places shall be counted the Golden number: as one in the first place, two in the second, and three in the third, returning forwre to the first place, &c. vntill the golden number of that yeare, for the which the concurrent is sought. And the number of that place where the Golden number endeth, must be ioyned with the number of the golden number, and that doth amount thereof, shall bee the concurrent, so that it passe not thirty, but if it passe thirty, then that, that is more then 10, is the Concurrent of that yeare.

And here is to be noted, that the yeares of this computation of the Moone, beginne at the first day of March, & last vntill the last day of Februarie, so that this present yeare 1609 by computation of the Golden number, wee haue 14, which accounted by the saide places endeth in the second, which is 20, the same ioyned with the golden number of 14, makes 34, which beeing more then thirty, the

said 30. taken away, leaues 4. for the Epact or concurrent of this present yeare 1609.

Likewise this number of Epact or Concurrent is found in multiplying the Golden number by 11. and deuiding the summe by 30. then that remaineth, is the Epact or concurrent.

The concurrent being thus knowne, then to know the dayes of the Moone, it is necessarie to know three numbers: the first, is the concurrent, the second, the number of the moneth in which you are, beginning at March: the third the dayes past of the same moneth. And ioyning these three numbers, if they come not to 30, so many dayes olde is the Moone. And if they bee thirty, it is the Coniunction, And if they passe thirty, they also that passe, are the age of the moone.

This is vnderstoode in the monethes that haue 31. dayes, for in them that haue onelie 30. dayes, the coniunction is at the 29. day, and they that arise of 29. are the age of the Moone. As for example, the first day of August, of the Epact, foure monethes from March 6. and dayes of the moneth, 1. make in all 11, and so much is the age of the Moone for the day aforesaid.

Again the 20. of September of the Epact 4, of moueths 7. and dayes of the moneth, 20. makes 31, and because that September hath but thirty dayes, we must take away 29. from 31. so there resteth 2 dayes which are the age of the Moone, so in like manner, we must giue to February 29 dayes of the moone.

It followeth, that the dayes of the Moone being knowne, then vnreckoning or disreckoning backwarde, we finde for example. The 20. of October the Moone hath 2. dates, which taken from the 30. remaineth 18. then the 18. day was the coniunction.

The day of the coniunction is likewise known by ioyning the Monethes (beginning in March) with the Concurrent, and if they come not to 30. then at so many dayes

of

of that moneth as lacketh of 30. shall be the coniunction.

Example.

In August of the monthes 6, and of the concurrent or Epact 4, are 10, which wanteth of 30. 20. then at the 20 day was the coniunction, but if it be so that they passe 30, then taking them that passe 30 from the number of dayes, which the month next before had, that which remaineth doth shew the day of the Coniunction: As for example, the moneth of December of the yeare to come 1610, wee shall haue of the Epact 26, which added with 10, the number of Monethes from March, make 36, then subtract 6, the ouerplus of 30, from 30, the dayes of November, the moneth next before, and there remaineth 24: then I conclude that the 24 of November 1611, the moone shall make Coniunction.

CHAP. VII.

Of the Declination and Vse of an Instrument, by the which is found the place and declination of the sunne with the dayes and place of the Moone.

IN the second and third Chapter I haue giuen Rules to know the true place of the Sunne, and his declination. In this Chapter I will describe an Instrument, whereby may bee knowne the declination and place of the Sunne, and knowing by the Chapter past, the dayes of the Moone, shall also be knowne her place in the Zodiacke, and how much of her is lightened, and what aspect shee hath with the Sunne.

This Instrument is in square forme, and hath by the sides 23 degrees and a half, of the which the 23, and a halfe that descend from the middest downewarde, is the declination of the South Signes: and the other from the middest vpward, are the declinations of the North Signes:

With-

Within this Quadrature is described a Circle, by the circumference whereof are the twelue signes and their degrees ioyned to the circumference: and further within, is the number of them, and then their names. Yet further within this, is another Circle, where are the twelue monethes, with their numbers and dayes.

Then to the center of this circle, are annexed two rundels, whereof the greatest and lowest is called the rundell of the sunne

This hath an Inder or shewer, in which is pointed the sunne, and in the circumference of it, are the dayes of the age of the Moone. In the other circle, in the circumference thereof, is a round hole, representing the Moone, directly from the which, is another Inder comming forth of the circumference of this rundell, in which rundell are all the aspects, which the Moone maketh with the Sunne.

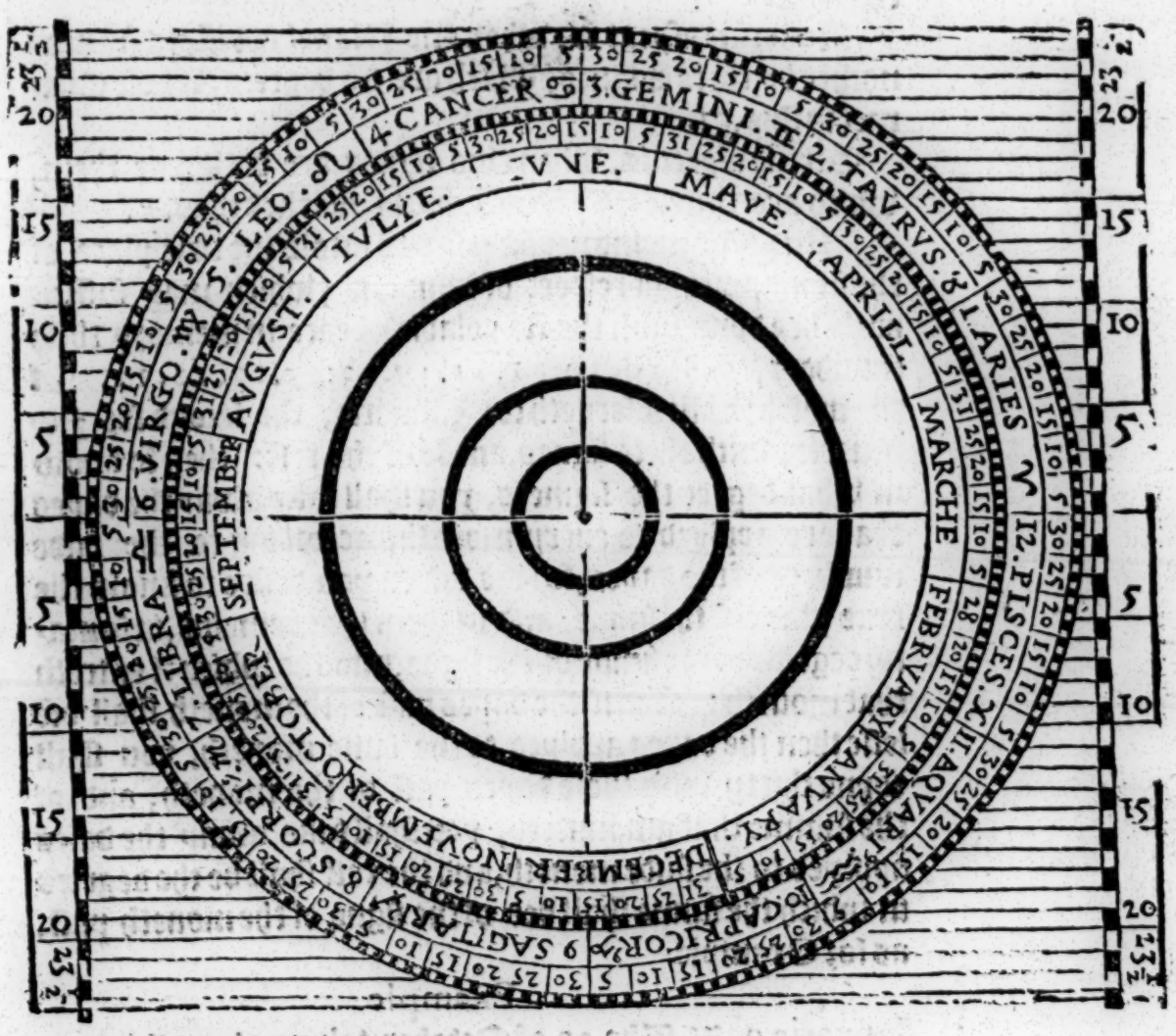
Hauing described the Instrument, let vs declare the vse thereof, which is this.

First, to finde the true place of the Sunne, we must put the Inder of the rundell of the sunne, vpon the day of the moneth in which we are, or desire to know the place of the sunne: then in the circle of the signes, it shall shew the signe and degree in the which it is, and in like manner, resting still vpon the degree, looking in the Paralels that touch in the circumference, and proceeding by that line that toucheth the sunne, which the Inder doth note, ye shall see in the side of the Instrument, the number of the degrees of the declination, which the sunne hath at that day.

To finde the place of the Moone, we must hold the Inder of the rundell of the sunne, fast vpon that day of the moneth, in the which we desire to know the place of the moone: And accompting in the rundell of the sunne, the dayes that haue passed from the day of the coniunction (as I haue saide in the Chapter before) and where endeth that number of the dayes, if there wee apply the Inder of the Moone, it shall shew in the Circle of the signes, the place where she is. And

so

so shall she appeare in the Instrument lightned or darkned, more or lesse as in heauen. In like maner, considering the place of the Sunne and the Moone, shall be seene what aspect they haue, by the lines that trauerse the superficiall of the Lunar circle of the moone.



The aspects which the Planets haue one to another, or whereby they behold one another, are fiue.

Coniunction is, when two planets be vnder one selfe same degree and minute in the Zodiacke, whose charact is this ☌

Op-

Opposition is, when between the place of the Planets is halfe a Circle, where are 180. degrées, and is thus figured, ☍.

Trinall aspect is, when betwéene the Planets shall be foure Signes, which are 120. degrées, and is figured thus, △.

Quadrine aspect is, when one Planet is distant from another by three Signes, which are 90 degrées, whose Charact is this, □.

Sertile aspect is, when two signes are betwéene them, which are thréescore degrees, and is marked thus, ✶,

And if by memory you desire to know the true place of the sunne, without respect of minutes (which may sufficiently bee done with the Astrolabie) beare in memory these numbers, 9.8.10.10.11.11.13.13:13.13.12.11. Of the which the first serueth for Ianuarie, the second for Februarie, with their signes, and so of the rest: then to know in what degree the sunne is, you shall take away the dayes that are applyed to euery moneth, according to the saide numbers of the dayes, for the which you desire to know the true place of the sunne, and in them that remaine, in so many degrées is the sunne of the signe, into the which it entreth that moueth: And if the dayes past of the moneth, shall bée lesse then the dayes applyed to the same moneth, you shall ioyne thirty with those dayes past of the moneth, and of the summe that amounteth, you shall take away the daies applyed to the saide moneth, and the rest shall be the degrées in which the sunne shall bee of the signe of the moneth past, as for Example.

Example.

Ianuarie	9 ♒	The 22 of October, taking away thirteene
Februarie	8 ♓	that were applyed, remaine nine degrees
March	10 ♈	of Scorpio, where the sunne is.
April.	10 ♉	Another Example.
May.	11 ♊	The sixt of December, which are lesser
Iune.	11 ♋	then twelue, which is applyed vnto it, if we

ioyne

July 13 ♌ toyne fiue to thirty, which are the dayes
August 13 ♍ of the moneth next afore, they make 36
Septemb. 13 ♎ and from them we take away the 12. reſt
October 13 ♏ 24. ſo in 24 degrees, is the ſunne of the ſigne
Nouemb. 12 ♐ of the Moneth before, which is Sagit-
Decemb. 12 ♑ tarie.

CHAP. VIII.

Of the Eclipſe of the Moone and the Sunne.

THe Eclipſe of the ſunne and of the Moone, is a thing that cauſeth great feare and admiration among the common and ignorant people, and to them that vnderſtand the cauſe thereof, nothing at all. And therefore haue I thought good to declare the Effects thereof.

The Eclipſe of the Moone, is the interpoſition or being of the earth, betwixt her and the ſunne. And whereas the Moone hath no proper light of her owne, and the earth being darke and not tranſparent, maketh his ſhadow on the part oppoſite to the ſunne: the Moone by her proper motion doth paſſe by this ſhadow, and is Eclipſed or darkened eyther in the whole or in part, according to the portion of her that paſſeth by the ſhadow. Moreouer, (as we haue ſaid) that onely the ſunne is mooued in the Line Ecliptick, and the earth being in the center of the worlde the point or pricke of the ſhadow ſhall bee vnder the Ecliptick. The Moone declineth from the Ecliptick ſometimes to the one part, and ſometimes to the other, becauſe her Eccentricke wherein ſhee is mooued, doth cut the Ecliptick equally into two halfes, ſo that the one halfe of the Eccentricke doth decline from the Ecliptike toward the North part, and the other halfe toward the ſouth, and the greateſt declination of it from the Ecliptick, is fiue degrees. In that manner the Moone ſhall bee at no time in the Ecliptick, but onely when ſhee ſhalbe in either of the interſectiõs, where the eccentrick doth

cut

cut the laide Eclipticke. That intersection where shee passeth and goeth toward the North part, is called the head of the Dragon, and is marked thus ☊. The other where shee passeth and declineth toward the south part, is called the tayle of the Dragon, and is marked thus ☋. And the Sunne mouing by his proper motion, and comming to the head, then shall the shadow of the earth bee in the tayle, because it is the point opposite, and if then the Moone come thither, of her proper motion she passeth by the shadow, and lacking light of the sun, shee is eclipsed: and if the Sunne come to the tayle, the shadow is in the head, &c. then likewise shall the Moone bee eclipsed, if shee passe by the head.

It is to be vnderstood, that the sunne is much bigger then the earth, and by perspective, the shadow of the earth, in how much the further it parteth from it, becommeth sharper and sharper, vntill it come to a point: so that the shadow of the whole earth, is piramidally sharp: and as the Moone is lesse then the earth, yet (although his shadow goeth sharpning) it sufficeth to eclipse the Moone, if shee passe by the middest thereof.

The Eclipse of the sunne is the interposition of the Moone

Moone betweene vs and the sunne, as if the sunne be in the fourth heauen, and the moone in the first, shee being a darke body, and by her proper motion ouertake the sunne, then putting her selfe betweene him and vs, shee couereth him in part, or in the whole: and this is the eclipse of the sunne: as the sunne also goeth euer vnder the Ecliptikes, at that time that hee commeth to the head or tayle of the Dragon, if then the moone make coniunction with him, shall bée the Eclipse of the sunne, for as much as they are both vnder the Ecliptike.

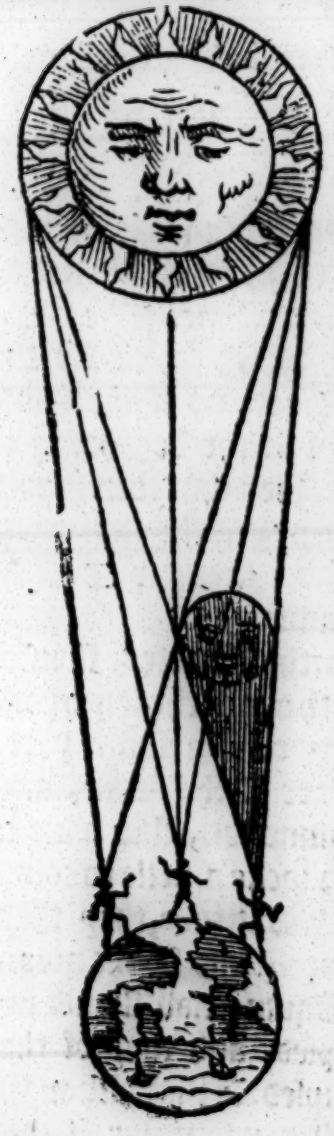
The Eclipse of the sunne cannot be vniuersall in the whole earth, I say, vnto all them that may sée the sunne at the time of the Eclipse, as is the Eclipse of the Moone vniuersall. For if the Moone haue one part Eclipsed, all that may sée her, shall sée her Eclipsed: But the sunne some may sée all wholy eclipsed, and other in part, or other also not at all Eclipsed: and this all at one selfe same time. The cause whereof, is the diuersitie of the aspect, which is, to sée the Moone in the Zodiacke out of her place, as if the sunne and Moone should make coniunction in the beginning of Aries, and in the head of the Dragon, they that then should bee in the Equinoctiall, vnder the sunne and the moone, or that the sunne and the moone should bée in their Zenith, they should see the moone hide all the sunne.

And they that should be in the north Climates, should see that the Moone hideth or darkeneth onelie the south part of the sunne and not all: againe, they on the south part, should see the moone hide the North part of the sunne, and not all: and if at the time of the Coniunction, shée haue a little passed the head of the Dragon, or lacke a little to come to the tayle, so that shée be in the North Latitude, they that then should be in the North Climates, should sée the moon Eclipse all the sunne, and they of the Equinoctiall should sée onely the North part of the sunne eclipsed, and they of the south should see him nothing at all Eclipsed: so that although the Eclipse of the sunne shall bée totall or particular, it can

not

not bee vniuersall in the whole Earth.

And note, that for the quantity of these Eclipses, the Astronomers deuide into twelue equall parts, aswell the Diameter of the sunne, as of the Moone, and these partes they call figures, puncts or prickes, and according to the puncts of the Diameter of the Moone, which is couered by the shadow of the earth, or the parts of the diameter of the sunne, which the moone doth couer, so many fingers or punctes shall bee said to be Eclipsed: as if 6. the halfe, if 3. a quarter, if 4. a terce, or third part, if 6. three quarters, if 8 two terces.



It is also to be noted that although the sunne bee bigger then the Moone, yet at sometimes the Moone seemeth greater then the sunne: and this shalbe when the sunne is in the Auge of the Eccentricke, and the moone in the oppoſite of the Auge of the Epicicle.

And when it so appeareth, hee may be all Eclipsed. Sometimes also the Moone seemeth lesse: this is when the sunne is in the oppoſite of the Auge of the eccentricke, and the Moone in the Auge of the Epicicle: then although we should see the Center of the moone in the center of the sun, she cãnot hide him all wholy, because the sunne shall appeare greater.

Of this that we haue said, it followeth that all the Eclipses of the sunne, must of necessity bee in the coniunction, and the Eclipses of the Moone in the Oppoſition: whereby

whereby is inferred, that the Eclipse of the Sun in the death of Christ our Redéemer, was not naturall, but miraculous: forasmuch as then was xv. dayes of the Moone, at which time the Moone is at the full, and farre distant from the sunne, and could not Eclipse him. In like manner is to be noted, that to see the Eclipses, they of the sunne must bée in the day, and they of the Moone in the night. And whether the Coniunction be in the night, or the opposition in the day, the Astronomers make none account.

CHAP. IX.

Of Time, and of the Definitions thereof

FOrasmuch as hetherto wee haue entreated of the mouinges of the Sunne, and of the Moone, and how all mouing is in time, (for that nothing may bee mooued in any instant or out of time) it shall bee conuenient now to declare what thing time is, and into what parts it is deuided.

Time (as sayth the Philosopher) is a measure of mouing, according to first and last, or before and after. Although by Accident (as Armandus hath subtilly defined.) Time may bée a measure of rest or quietnesse: as measures of habites, or measures of priuations. Or Time may bee a measure of the mooning of the first moueable, called Primum mobile, and cause of generation thereby, and of corruption by accident. Time hath the limits, that hath the world, and as the world, so is it the cause of the mooning of the Heauens, and beganne when God created the Heauens, and shall end when the world shall haue an end, as the holy Schooles of Diuines teach vs. It is assigned to bee within the Heauens, forasmuch as without them, is neyther Time, nor any naturall place. All the time since GOD created the world, vntill it shall haue an end, is called Seculum,

(that is) a worlde, or an age of Time. Albeit the worde Seculum in an other sense, may be extended farther then the durability or continuance of the worlde, and this in holy Scripture is called Seculum seculi, that is, the worlde of the worlde: or Secula seculorum, which is as much to meane, as, the worlde and the worldes to come, which signifieth Eternity, or euerlasting worlde without end. Likewise also, seculum is taken for the space of an hundred yeares, whereby in olde time certaine playes were called Seculares, because they were celebrate from a hundred to a hundred yeares. The Pope Paul the third of that name, commaunded them to be celebrated in Rome, in the yeare 1536. which was the yeare in the which the Seculum ended, and beganne a new Seculum.

And as in time are diuers mouinges, so hath it diuers measures, whereof some are greater, other lesse, The greatest measure of time, is a reuolution of the heauens, which is slowly moued, and the principall or chiefe of these, is that the Sunne maketh, which we call a yeare. The lesse measure, is the mouing of the first moueable, which moueth most swiftly: and this measure we call a day. And for asmuch as there is variation in the greatest measures, wee will in the Chapter following intreate of the yeare, and of the diuersity thereof,

CHAP. X.

Of the yeare, and of the diuerse beginnings and reckonings, or computation had thereof in olde time.

There are three differences of the yeares, as the great yeare, called Annus magnus, the Solar yeare, and the Lunar yeare. The great yeare is the space of time, in the which all the Planetes returne to the place, where they had beene sometime before. As if they

they all had beene in the beginning of Aries, and had begunne their course from thence, and should againe all returne thither, then should be the great yeare.

By the description of other, the great yeare is when the eight Spheare toyntly with all the Auges, make one perfect reuolution at the mouing of the ninth Spheare. And this shall be in the space of 49. thousand yeares.

The Solar yeare is a reuolution of the sunne, carried by the proper mouing of his heauen vpon his Axis and Poles of the Zodiacke, ending where it begann, and returning an other yeare by the selfe same Course, as the Poet Virgil affirmeth.

Atque in se sua per vestigia volvitur annus.

That is to say, the yeare turneth againe to himselfe by his owne proper steps.

The Egyptians lacking the vse of Letters, and hauing the same consideration, painted the yeere like vnto an Adder, byting her owne tayle: and hereof was a Ring called Annulus, as it were Annus (that is a yeare) because a Ring turneth round in it selfe, as doth the yeare: Of the quantity of this yeare were diuers opinions and computations among them of ancient time. The Arabians and Persians accounted it regularly by twelue Moones, which are three hundred fifty foure dayes. Romulus gaue to his yeare ten Monethes, because that time sufficeth to a woman to bring foorth her birth, and also for that during so much time, it was not lawfull for a Widdow to marrie after the death of her husband Numa Pompilius added two moneths, to make it vp twelue Monethes in 350 dayes, which was the most auncient yeare of the Hebrewes, according to the which they account at this day. The Greekes and Egyptians considering the course of the Sunne, made the yeare of three hundred sixty fiue dayes: then by the commaundement of Iulius Cæsar (whose order we now obserue) were added fiue howres, to the end to make equall this number of

dayes with the course of the sunne, and hereof the Bisextile or leape yeare had his beginning, from foure to foure yéers. But to say the truth, they erred, the one by somewhat too much, and the other by somewhat too little.

This yeare containeth 365 dayes, 5 howres, and 49. minutes.

Likewise at the first, the yeare had diuers beginnings: Numa Pompilius beganne it from the Winter Solstitiall, because that then the sunne beginneth to rise towards vs, as Ouid affirmeth in these verses.

Bruma noui prima est, veterisque nouissima Solis,
Principium capiunt Phœbus & Annus idem.

Which may be thus Englished.

Brume is the first of the new yeare,
And last day of the old:
The Sunne and yeare beginne at once,
As Ouid hath vs told.

Romulus beganne it at March, at the Equinoc of the spring, because that then all things reuiue and flourish: And by the Opinion of the Diuines, it seemeth good reason to beginne the yeare at March, because the world was created the 25 of the Kalends of April, which is the 18 of the Moneth aforesaid. Likewise God speaking of this moneth to the people of Israel, said vnto them: This shall bée the first of the Monethes of the yeare: The Arabians beginne from the summer solstitiall, whose opinion is, that the sunne was made in the signe of Leo. Other beginne the yeare in September, about the Equinoctiall of Autumne, as doe the Iewes, resting in the authority of Genesis, where it is written thus, Let the earth bring forth grœne hearbes, to haue fruit agréeable to their kind, &c. And because Autumne is a fruitfull time, they beganne from thence to account their yeare. The Grœkes, Persians, and Egyptians account it from October. The Christians, some from the

Incar-

Incarnation of Christ, other from his birth, and other from the first day of January.

In like maner is great diuersity in beginning the number of yeeres, which we call æra, that is the date. The Greekes beganne their date from the death of great Alexander. The Egyptians from the death of Nabuchadnezer The Persians from Gesdargit. The Arabians or Moores from the preaching of Machomet, who was after the birth of Christ 626 yeeres. Other also from the Romaine Emperours. The Christians beganne the account of our Sauiour Iesus Christ 500 yeeres after his birth, as writeth Cardinall Cusanus. And here it shall not bee from my purpose, to shew how iustly and rightfully was commaunded by Don Iohn king of Spaine the first of that name, that in the Courts and Parliaments, which he held in Segouia, in the yeare 1383. leauing the dates that they had begunne from the Emperour Octauian, for tributes and other payments specified in Writings and Priuiledges, they should no more put the date of the Emperour, for as much as the day in the which the Sonne of GOD became man, and was borne by the blessed Virgine, was so excellent a thing, and most worthy to be had in memory. So that in Spaine, since that time, in all common Writings, the date is made from the Natiuity of our Lord, beginning there the first day of the yeare, and commonly the first day of January: some Astronomers begin it the first of March.

We haue in this Chapter entreated of the great yeare, and of the Solar yeere with his quantitie, beginning and date. In the Chapter following, we will entreate of the Lunar yeere, which we call a Moneth.

CHAP. XI.

Of the Moneth, and of his differences.

COnsidering the Moneth absolutely without hauing respect to the solar yeare, it may bee called a yeere

according to the diuision wee haue made in the Chapter of the yeare. For it is a reuolution of the heauen of the moone which moueth slowly in comparison of the first heauen. And if wee consider the Moneth as parte of the yeare, then is the name of a Moneth more proper vnto it. For this worde Mensis, in Latine is derined of Mensura, which signifieth measure. And so the Moneth and yeare referred to time, all may be called moneth, forasmuch as all is the measure of time, as we haue touched in the said Chapter of the yeare.

The Moneth is to bee considerd in two manners, eyther (as it is) part of the Solar yeare, or is caused by the course of the Moon. The Moneth that is part of the Solar yeare, is that which at this day we vse. And into twelue of these Monethes is the yeare diuided, as January, Februarie, March, April, May, June, July, August, September, October, Nouember, December.

They are not all of equall dayes, April, June, September, and Nouember haue thirty dayes, all the other haue thirty one, except Februarie, which hath twenty eight, and when the Bisextile or Leape yeare is, it hath twentie nine. The names and numbers of these Monethes were assigned at the will and pleasure of men, and the cause why they haue remained so long time, is the authority of the Emperours, that ordained them for the common people, who accepted them by the Romaine Church, which admitted the vse of them.

The Lunar Moneth hath two considerations. The one is the time which the Moone tarrieth from that shee commeth forth from one point of the Zodiacke, vntill shee returnethither by her proper mouing, and this is called the Moneth of the peragration, in which reuolution she spendeth twenty seauen dayes, and almost eight howres. The other consideration is, hauing respect to the time which the moone tarrieth, from that she is in coniunction with the Sunne, vntil another coniunction, and this is called the monthy of conjunc-

tion

tion, and is more then the Moneth of the Peragration, by two dayes, 4 howres, 44 minutes: for the sunne and the moone being in Coniunction vnder one point of the Zodiacke, and mouing both by their proper motions toward the East, as the mouing of the Moone is swifter then the mouing of the sunne, shee leaueth him behind.

And when shee hath ended her Moneth of peragration, shée returneth to the point from whence shee departed, and not finding the Sunne there (because in the meane time the Sunne of his proper motion hath gone almost 27. degrées) the Moone palleth from this point, and in the said two dayes, foure howres, 44. minutes, ouertaketh the Sunne, and so commonly hath this Moneth of consecution, 29 dayes, 12 howres, and 44 minutes: So that whatsoeuer is said of the Lunar Moneth, is to bée vnderstoode of this Moneth of Consecution, which all they vse that account by Moones: as doe the Hebrewes, Arabians and Persians.

The Mariners ought not to neglect this Computation because it is conuenient for them to know the tides, and other Effects, caused by the aspectes of the Sunne and the Moone, for their aspects doe correspond to the partes of this moneth, as the coniunction to the beginning, the opposition to the middest, and the quartile aspect to the quarter, and so of the other. Likewise in this moneth, is considered the illumination of the Moone, and the dayes that the light faileth her: so that neyther by day nor by night wée may sée her: for béeing burnt vnder the beames of the Sunne. The time that shée is so, is called Interlunium (that is) the change or hiding, which is sometime more, and sometime lesse. When the Coniunction shall be from the beginning of Capricorne vntill the end of Gemini, and the Moone hath North Latitude, and her mouing swift: then shall the New moone soone bée seene, and so shall the Interlunium bee but little. And when the Coniunction shall bee from the beginning of Cancer, vntill the end of Sagittarius. and

the Moon hath south latitude, and her mouing slow, the longer will it be or the new Moone shew her seife to vs, and certaine of the causes concurring, and not all, so shal the Interlunium be in a meane betweene both. There is also an other month, which is called the month of Apparition, which consisteth of 28 dayes, deuided commonly by foure weekes, each weeke containing seuen dayes, for foure times seauen is twenty eight, of which foure weekes the first is counted from the first appearance of the ☽ till the seuenth day, and so forth from weeke to weeke, so as the fourth weeke endeth at the twenty eight, in which account the odde howres during the Moones abode vnder the beames of the ☉, when she is saide to be combust, are not reckoned.

CHAP. XII.
Of the Weeke.

The Weeke is a time of seauen dayes, the beginning whereof is sunday, and so did the Iewes count their first day, saying, prima Sabati, secunda Sabati (that is) the first of the sabaoth, the second of the sabaoth, &c. to the sixt of the sabaoth, and then the sabaoth: the Romaines that called the planets Gods, for asmuch as the sunne was principall among them: called their first day, the day of the Sun, the second of the Moon, the third of Mars, the fourth of Mercurie, the fift of Iupiter, the sixt of Venus, the seuenth of Saturne. The Christians solemnizing the Sunday, began their account from it, as on such a day our Lord was borne, on such a day hee rose: and on such a day hee sent the holy Ghost vpon his Apostles, &c: they also account the dayes of the weeke for Ferias.

CHAP. XIII.
Of the day and of the night.

The day is of two sorts, as the naturall day, and the artifi-

artificiall day: the naturall day, is the space of time, wherein the sunne is carried by the first mouable about the earth: from the Meridian to the West, and from the West vnder the earth, comming to the East, and from thence returning againe to the said Meridian: and in this time hath the Equinoctiall giuen one whole turne and more, such part of it as correspondeth to the proper mouing of the sunne: or otherwise, the naturall day is a Circle described with the center of the sunne, at the mouing of the first moueable: the Romaines beganne this naturall day, from midnight, and ended it in the midnight following, and so we account it, for fasting dayes, and from euening to euening, in celebrating of festiuall dayes: the Athenienses beganne it at the sunne set, or going downe of the sunne: the Babylonians, at the rising of the sunne: the Umbrians and Ethuscos, from the mid day, or noone, and ended it the noone day following. In this manner doe the Astronomers beginne it, and find that the day shall euer beginne at one selfe same howre for the quality of the Meridians. And if they had begun it from the rising or fall of the sunne, it should not be euer at one selfe same houre, because the sun riseth and falleth at some times sooner, and at other times later: and so should the beginning of the day bee variable: it is to bee vnderstood, that when we commonly say, at the tenth day of such a moneth: the same tenth day doth end the same day at noone, and the howres that runne from that noonetide forward, are of the eleuenth day, and so doe the Astronomers account them.

The day artificiall, is a part of the day naturall, and is the time that the sunne tarrieth from that it ariseth in the East, vntill it fall in the West: and the night is that part that lasteth or falleth for the naturall day, which is the time that the sunne tarrieth from that hee hideth himselfe in the west, vntill hee returne to appeare in the East: and so the day artificiall and the night, make one naturall day: and according hereunto, it is written in Genesis, that of Euening

ning and morning was made one day. Isidorus defining this artificiall day, saith, that the day is the presence of the sunne, or the beeing of the sunne aboue the earth: as it is night vnto vs when he is vnder it. Or otherwise, the night is the shadow of the earth, extended diametrally opposite to the sunne. The quantity and differences of these dayes artificiall, and their nights, and how they encrease and diminish, we haue largely declared in the first Chapter.

CHAP. XIIII.

Of Howres.

As there is two differences of the day, as the naturall day and artificiall: so is there 2 differences of howres, as howres naturall, which correspond to the naturall day, and howres artificiall, which correspond to the Artificiall day: Hora or Ora is a Greeke name, and signifieth end. And to say we Ora Maris, for the ende or brimme of the sea, or the list or edge of apparrell, as saith Isidore in his Etimologies: the howre naturall or equall, is a 24. part of the day naturall, and is the time of passing fifteene degrees of the Equinoctall. These 24. howres that make one Naturall day: the Astronomers doe beginne the day at the Meridian, counting the howres after the order of the first moueable, which is from the said Meridian, in the Angle of midnight, where they account twelue howres, & from thence towards the East, and come to end the 24 howres in the same Meridian where they beganne, and this they vse for the computation of the Tables of the mouings of the heauens. The Astronomers vse the same in their Instruments, as in the Astrolabie, and Dials Horizontall, and verticall, and in all other Instruments for howres. In Spaine also wee vse to account these twenty foure in two times twelue, beginning at noon, and ending at twelue at midnight: and againe, beginning at midnight, and ending other twelue at noone. And to distinct the one from the other, they call the one after-

afternoone howres, and the other forenoone howres, and commonly we say fiue howres of the morning, and fiue of the euening. In Italy they account them from the falling of the Sunne, vntill the next fall the day following.

The Artificiall or temporall howre, is a twelfe part of the day arcke, or the nightarcke.

They are called temporall howres, because they varie in the times that the day varieth: For in the time that the dayes shall bee great, so shall the howres: and when the dayes shall bee short, so likewise shall the howres be, and in like manner of the nights, so that as the artificiall day great or little, is diuided into twelue houres, euen so the night great or little is diuided into other twelue. The Auncientes diuide the day into foure partes, and the night into other foure, giuing vnto euery quarter part three howres. At the rising of the Sunne, which was the first howre of the first quarter, they called the first howre, and three howres passed, they called the third howre, and fiue howres passed of the day, they called the sixt howre, which was the midday or noonetide. Also the ninth howre they named at nine howres past of the day. And the Sunne set, or going downe of the Sunne, they called the Euening, as sayth the Poet Virgil in this verse.

Antedien clausam componet vesper Olimpo

And according to this Computation, it is to be vnderstoode that Saint Matthew writeth: That the Labourers came to the Vineyeard at the eleuenth howre, whereby is meant the fift howre, one howre before the Sunne was set. And when wee reade in Saint Iohn, The Ague left him the seuenth howre, &c. By this account it was one howre after Noone, when Christ healed the Sonne of the Ruler that was diseased in Capernaum. In like manner by these howres, the Auncientes deuided the Night into foure quarters, giuing three howres to euery quarter, And in these foure parts of the night, were Souldiers appointed to Watch. In the first quarter, which they cal-

call Canticinium (and wee the first sleepe) they watched all: In the second, which they call Intempestiuum, being the turne of midnight, the young men watched: in the third, which they call Gallicinium, of the crowing of Cockes, watched the souldiers of middle age: in the foure & last quarter, called Matutinum or Antelucanum (that is, the spring of the day) the old souldiers watched: and thus is vnderstoode, the first, the second, and third watch of the night, in like manner ought the Mariners to keepe watch and ward, to auoide aswell the perill of the sea, as also the danger of the Rouers, and to diuide the night by quarters, after the manner of souldiers, as did also the Mariners in old time.

CHAP. XV.

Of the making and vse of an Vniuersall Diall for the Day.

WHereas in the Chapter before, we haue entreated of howres, and their differences, wee entend here to describe the making of an Instrument generall, to know the howres of the day by the beames of the sunne, which is done in this manner. Take a round plate of Latine, and let it be called the Equinoctiall Circle, the circumference whereof you shall diuide into 24. equall parts, by both the sides, and from the Center to euery of these parts, you shall draw a right line: one of the which shall be a Meridian: and in the one part of that write twelue, which shall be the howre of the midday or noone: and in the other part, write other 12. which shall be for midnight. In the highest part, turning vpon the center, toward the right hand, write one, two, three foure, &c. In the lower or nether part, you shall count toward the left hand, turning it vpon the center, so that the one houre of the one part, come vpon the line of the one houre of the other part: in like manner two vpon two, three vppon three, and so foorth of the other. And note that

in

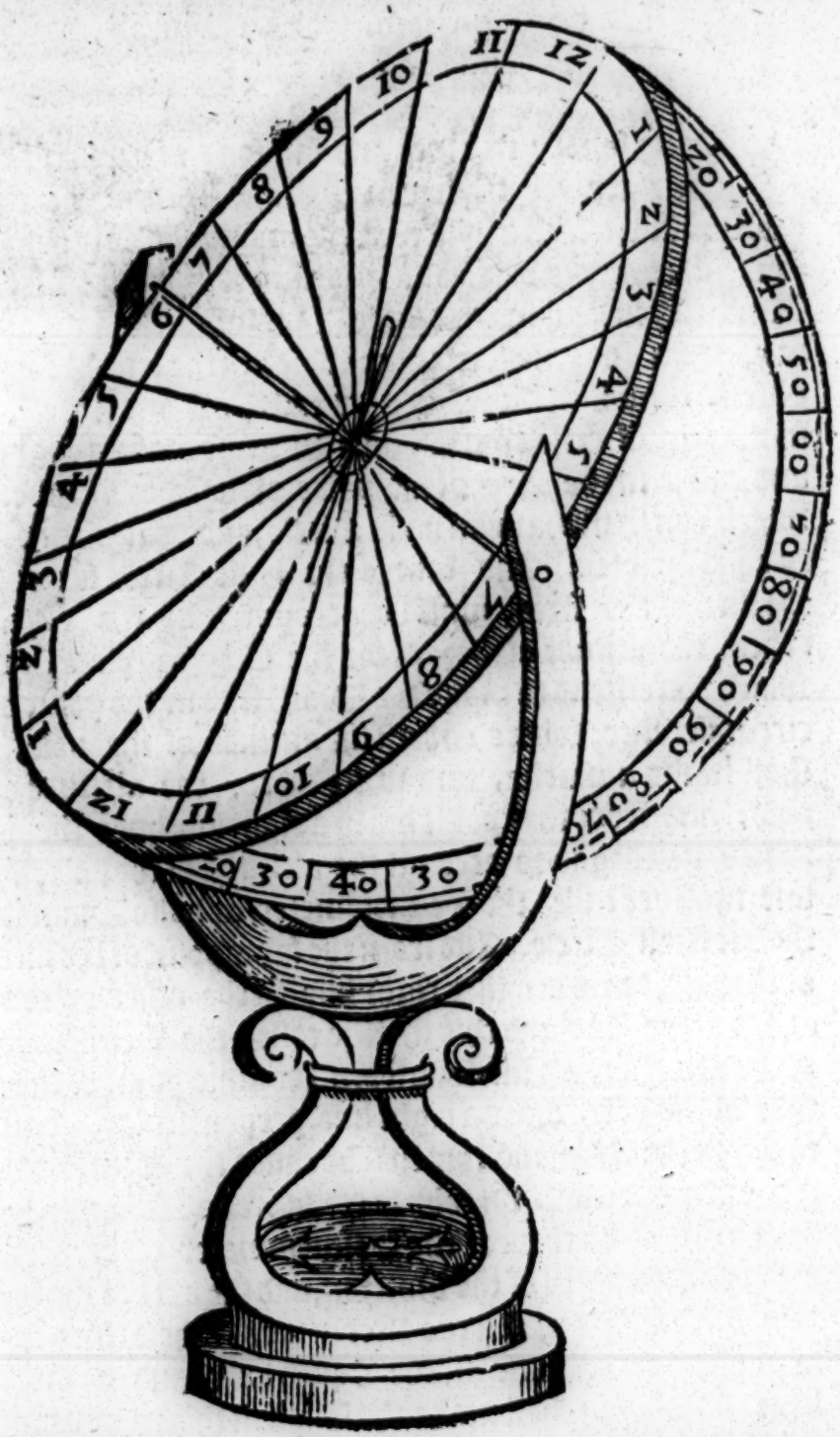
in the line of fixe at after noone, and at the line of the fixe in the morning there remaine certaine round peeces, corners, or endes, after the manner of Axis, of the thicknesse of the selfe same Plate. Then make a halfe Circle of the same mettall as bigge as the halfe circumference of the Plate, and of the thicknesse of a peece of foure ryals of Plate, or somewhat more, euen as the Plate it selfe, and of the breadth of halfe a finger, if the Instrument shal bee great, or lesse, if the instrument shall be lesse. This halfe Circle shall you graduate or diuide into a hundred eighty degrees, beginning at the one end, one, two, three, and so forth vnto ninety in the middest, and the like shall you doe from the other end vnto the same ninety. Also you must number them in the breadth of the same halfe Circle, and this halfe Circle shal you make fast on the neather part of the Instrument, so that the endes thereof may be fixed in the ends of the Meridian line. Then through the center of the plate or Equinoctiall Circle, shall passe a round steele or wyre of the same mettall, made fast or soldered in it, so that it rise and come forth equally from euery side of the plate and fourth part of the Diameter of the same, and this shall be called the Axis or Extreme of the world. The instrument being thus made, you shall place it, or set it in a frame, hauing two armes, standards or arches, so that it hange betweene the said arches, borne vp by the round peeces or ends of the plate, left thereof at the ends of the line of the fixe hours aforesaide, in such sort, that being thus stayed, it may be directly turned. And in the middest betweene these two armes, beneath in the foote of them, or where they are placed, you shall raise a pricke, or point, so that the plate which signifieth the Equinoctiall, being perpendicular, the brymme or edge thereof may fall vpon the point or pricke, and consequently the plate standing plaine or flat, the ninety degrees of the halfe circle, must shew or touch the saide pricke, as shall also the ende or extreamity of the Axis of the world, and the other ende shall shewe the Zenith or verticall point.

This

This Instrument must be so placed that the Meridian line be North and south, which you shall finde in this manner. In an open and plaine place, where the sunne shineth for the most part of the day, you shall make a circle with a payre of Compasses, in the middest whereof you shall set a Steele or wyer so vpright that it decline not, or bende not, eyther one way or other, and the same no longer then the fourth part of the Diameter of the Circle. Then in the morning when the Sunne riseth, the shadow shall bee very long, and as it riseth higher and higher, so the shadow waxeth shorter and shorter. Then must you obserue the time when the extremitie or end of the shadow toucheth in the circumference of the Circle, and where it toucheth, you shall make a pricke. Then goeth the shadow shortning vnto the midday or noone tide, and as from thence the Sunne declineth, so doth the shadow encrease, and when it shall come againe to the circumference of the Circle, you shall make another pricke. Then shall you part in the middest, the ark that is between the one prick and the other, and from the middle pricke, draw a right line to the Center of the Circle, and that shall be the Meridian line, whereupon you shall set the Instrument. Furthermore, in the foote of the frame of the Instrument, you shall set a Compasse or Dyall, which shall shew the Meridian Line. This done vpon the Arches of the frame, and corners of the fire bowles, you shall turne the Equinoctial, so farre that it passe so much of the halfe Circle by the middle pricke, how many degrees the Pole is raysed aboue the Horizon of that Region or place where you are, and then the shadow of the wyre or steele shall iustly shew in the Plate, the howre, and what a Clocke it is.

Here

Here followeth the Figure of the Inſtrument.



CHAP. XVI.

Of certaine particular Dials, Murall, and Horizontall.

AMong sundry manner and fashions of particular Dials, there are two principall. Whereof the one is Horizontall, which is placed in the superficiall of the Horizon: the other is verticall, and must bee made or set on a Wall perpendicular, and directly against the South or midday, from the true Leuant or East, to the true Ponent or West, the which the Mariners call East and West. To make any of these two Dials, you must draw a right line and call it in the Axis of the poles of the world, vpon the which you shall draw an halfe Circle, and deuide it in ninety equall partes. And where the halfe Circle is cut with the line of the Axis, must be accounted by the circumference, the altitude of the pole for the City or place, for the which you entend to make the Diall. And in the point of the circumference, where endeth the altitude of the pole, you shall make a marke, and write there, the altitude of the pole: and from that point draw a right line vnto the point where you began to account the altitude of the pole, which line shall bee called the Semidiameter, or halfe Diameter of the verticall Circle. And from the same point of the altitude of the pole, draw another right line to the other extremitie or end of the Axis, and this shall be called the Semidiameter of the Horizon, and likewise from the same point of the altitude of the pole, draw a right line perpendicular, vntill it touch in the Axis, and this shal be called the Semidiameter of the Equinoctiall. Hereby is considered a Triangle, which hath by the sides thereof the Semidiameter of the vertical, the Semidiameter of the Horizon, and the axis of the world; which Triangle shall serue afterward. These three Semidiameters of the verticall, the Equinoctiall and the Horizon being found, you shall make the Diall in this manner.

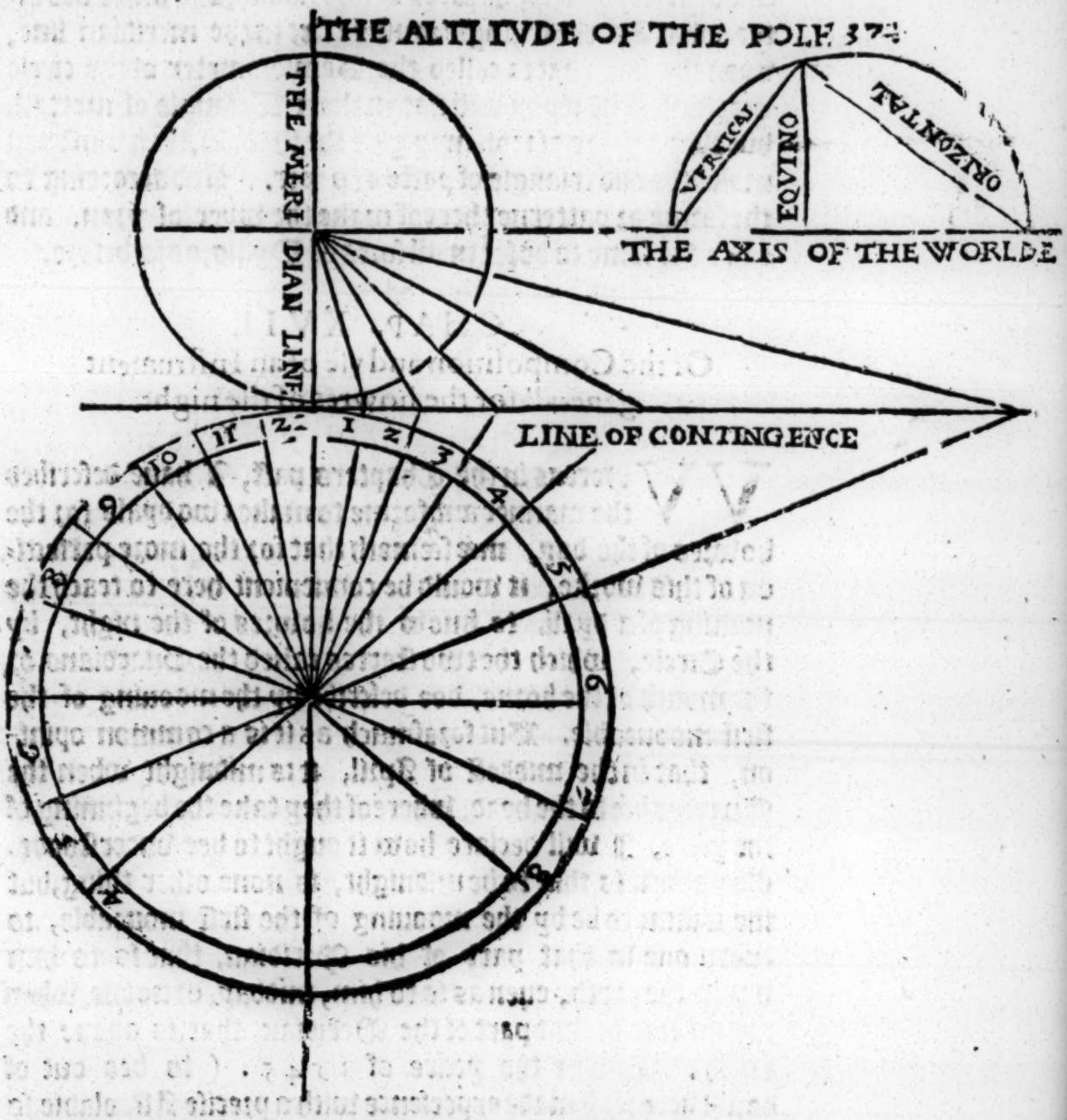
Draw

Draw a right line somewhat long, and call it the line of Contingence. This shall you cut with an other line in right Angles, after the manner of a Crosse, which shall bee the Meridian Line. Then with your Compasse, take from the Triangle the Semidiameter of the Equinoctiall, and of this bignesse draw a Circle vpon the Meridian line. so that the edge or brimme of the circle, touch in the Line of Contingence: then with a Compasse take the Diameter of the verticall circle, if you will make a morall Dyall, or the semidiameter of the Horizon, if you will make a Horizontall dyall, on a plaine or flat tourne. Therefore with such semidiameter as you desire, you shal draw a circle vpon the other part of the Meridian line, so that the circumference thereof touch in the line of Contingence, then shall you diuide the Equinoctiall circle into foure equall partes, and the quarter that is toward the line of contingẽce, shal you diuide into fiue equall parts. And setting the end of the Ruler in the center of the Equinoctiall, and vpon euery point of them that diuide the fiue equall parts, from thence shall you draw certaine right lines, vntill they touch in the Line of contingence. And from these points of the line of contingence, you shall draw other right lines, to the center of the Horizontal circle, which lines shall bee the determiners of the howres. And neare vnto the Meridian line, where it toucheth in the line of contingence, you shall write twelue, and consequently toward the East you shall write, one, two, three, foure, fiue, sixe, and from the first howre, you shall draw a right line, which shall passe by the center of the Horizontall circle, equally distant from the line of contingence. The one quarter of the Horizontall being drawne by the selfe same, and of the same measure and bignesse shall you draw the other, in such sort, that the same bignesse that is from twelue to one the selfe same shal you giue from the twelfth to the eleuenth, and the same bignesse and measure that is from one to two, shall you giue from eleuen to twelue, and so forth of the other.

And note that the Horizontall Dyall after the first houre of the Euening, shall haue the howres of seauen and eight, and in Climates farre North, 11 also, and more if need shal require, and consequently must haue the howres of fiue and foure of the morning, and in Climates farre North, three also: and these must bee so marked, that from sixe to seauen may be the same that is from fiue to sixe, and from seauen to eight, the same that is from foure to fiue: also, foure and fiue of the morning, as seauen and eight. The Diall being thus drawne in paper, or on a table, or any other thing, must be painted (on a Table, or in stone, or in what soeuer you desire to make the Diall) a circle of the same bignesse, as is the Circle Horizontall, and in that must be translated the Lines and Numbers of the saide Circle Horizontall. Then must you make a triangle of mettall, of the selfe same bignesse and forme that is made in the middle Circle: and the side of this Triangle (which is called the halfe Diameter of the Horizon) must be fixed vpon the Meridian line of the horizon Diall, so that the side of the Triangle (which is the Axis of the world) and extremity or end thereof, may fall in the Center of the Horizontall Dyall, and must stand so perpendicular, that it decline neither to the one part nor to the other. The Dyall being thus made, you shall set it vpon a Meridian line, so that the Meridian line of the Dyall may stand or rest vpon it, and so shall the shadow of the Triangle shew the howre, and if for this place we desire to know it, we must fixe it there, and if for any other place, so setting it, we shall haue a certaine howre: so may we in any instant remoue it to another place, and likewise set it there to make certaine and true demonstration of the Howre.

Here

Here followeth the Figure of this Demonstration.



In the manner as is made the Horizontall Dyall, must be made the verticall, taking from the Triangle the Semidiameter of the Circle verticall.

And note, that for the Circle verticall, it shall not be needfull of more then fiue howres before noone, and other fiue after noone. And the triangle must be set in the meridian line, vpon the side that is called the Semidiameter of the circle verticall. And if you will not make a Triangle of mettall, but that a wyre of iron may giue the shadow, then must you make the said triangle of paste or paper. And according to the forme or patterne thereof make the wyer of yron, and cause the same to be set in all sorts of Dyals, as is before.

CHAP. XVII.

Of the Composition and vse of an Instrument generall for the howres of the night.

WHereas in the Chapters past, I haue described the manner and forme to make two dyals for the howres of the day, mée seemeth that for the more perfection of this worke, it would be conuenient here to teach the making of a dyall, to know the howres of the night, by the Circle, which the two starres called the Guardians, or the mouth of the horne, doe describe by the mouing of the first moueable. But forasmuch as it is a common opinion, that in the middest of April, it is midnight when the Guardes bée in the head, whereof they take the beginning of the yére, I will declare how it ought to bee vnderstoode. Certaine it is, that to be midnight, is none other thing, but the Sunne to be by the mouing of the first moueable, to euery one in that part of his Meridian, that is to him vnder the earth, euen as is to him, midday, or noone, when to him it is in that part of the Meridian, that is aboue the earth. And in the yeare of 1545. (to bee out of doubt hereof) I made experience with a precise Astrolabie, so that the first or formost Guarde Starre, being perpendicularly ouer or aboue the North starre, I found in the Meridian, where the Sunne maketh midnight, the ninth degrée of Taurus, whereby it followeth that the Sunne being in this

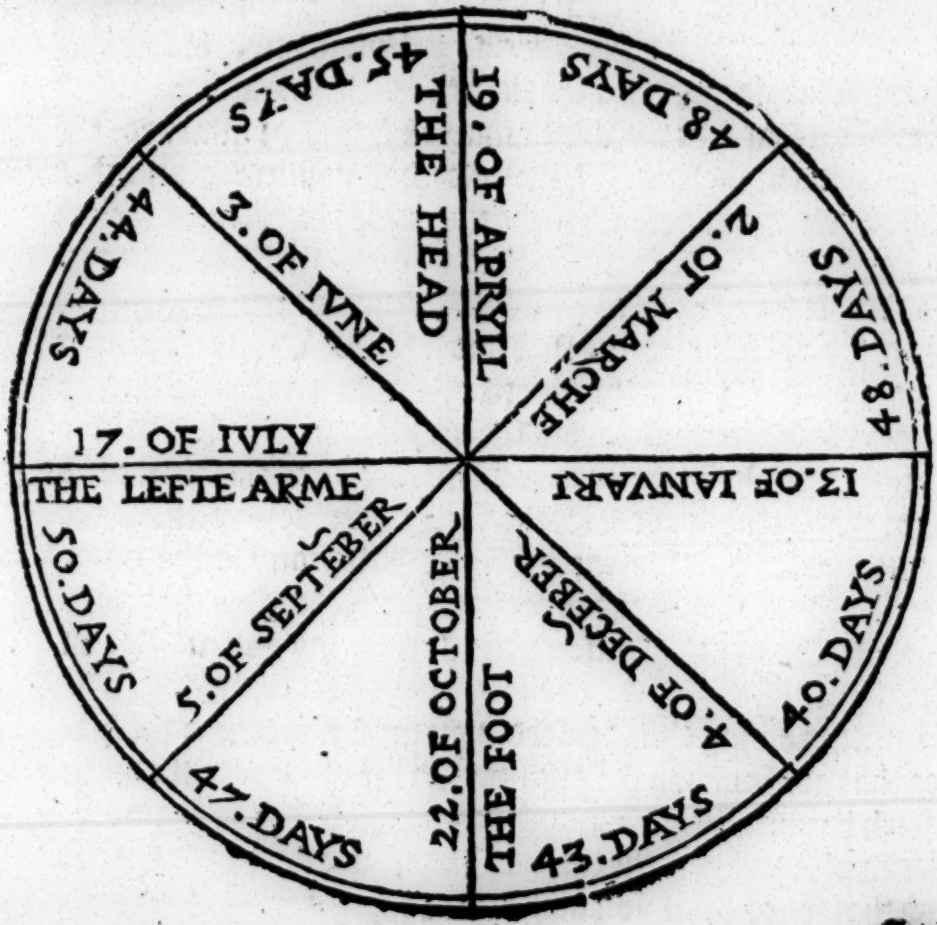
this degrée, which is at the 19 of Aprill, the same Guarde starre shall be perpendicularly ouer the North starre, which is the line of the head, and consequently, the Sunne béeing in the ninth degrée of Scorpio, which is at the 22. of October, the Guarde starre shall be in the line of the féete, and by this calculation may bée knowne when it shall bée in the right or in the left, and in all other lines: so that they manifestly erre, that account the midnight at the 15 of Aprill, when the first guarde starre is in the line of the head, accounting a terce or third part of an howre sooner and more then they should doe.

Hauing thus giuen principles for the Instrument, you shall proceede in the making thereof, as followeth: In paste or on a plate of latyn, make a circle of the quantity of a span or of the bignesse that you desire the Instrument or dyall to be: then make an other Circle somewhat lesse, so farre distant from the greater, that betwéene the one and the other may be a space, in the which may be signed or marked the dayes and monethes. Likewise shall you make an other lesse circle, leauing space to set the numbers of the dayes of euery Moneth. And vnder this Circle, shall you make another, leauing space to write the names of the monethes: then shall you diuide the first and greatest Circle into eight equall parts, so that the nineteenth of Aprill may bee in the highest or vppermost part of the instrument, which is where they say the line of the head to be, and the 22 of October must be in the neather part. Also the 13. of January in the right arme, and in the left arme, the 17 of July, and so the other dayes that doe fall to the other lines, according as they aunswere to the right assension of the sunne, as you may sée in this figure.

This béeing thus deuided, you must also diuide the spaces that are betwéen the one line and the other, into the dates which be numbred in euery space, so that between the nineteenth of Aprill, and the third of June, are forty fiue dayes: and that space shall you diuide into forty fiue partes: and

whereas the Instrument being small, it cannot in so litle space receiue so many parts, you shall diuide it from fiue, to fiue parts, and so shall you diuide the other spaces by the numbers that are signed in them.

Then one day more before the r. toward the left hand, you shall make a strike, and there shall be the twentieth of Aprill. And fiue dayes more before, make another strike, and there shall be the twenty fiue. And yet other fiue dayes more before, which shall be the thirtieth of Aprill, make another strike ouerthwart vnto the neathermost circle, and there shall May beginne: and from these dayes shall you begin to account the dayes of may from 5 to 5. And in the last space you shall put 6. which shall make the 30 dayes that May hath.



And

And there shall you make another strike, which shall traverse or ouerthwart vnto the lesse Circle. And in this manner you shall deuide the other monethes, giuing vnto euery of them the number of his dayes.

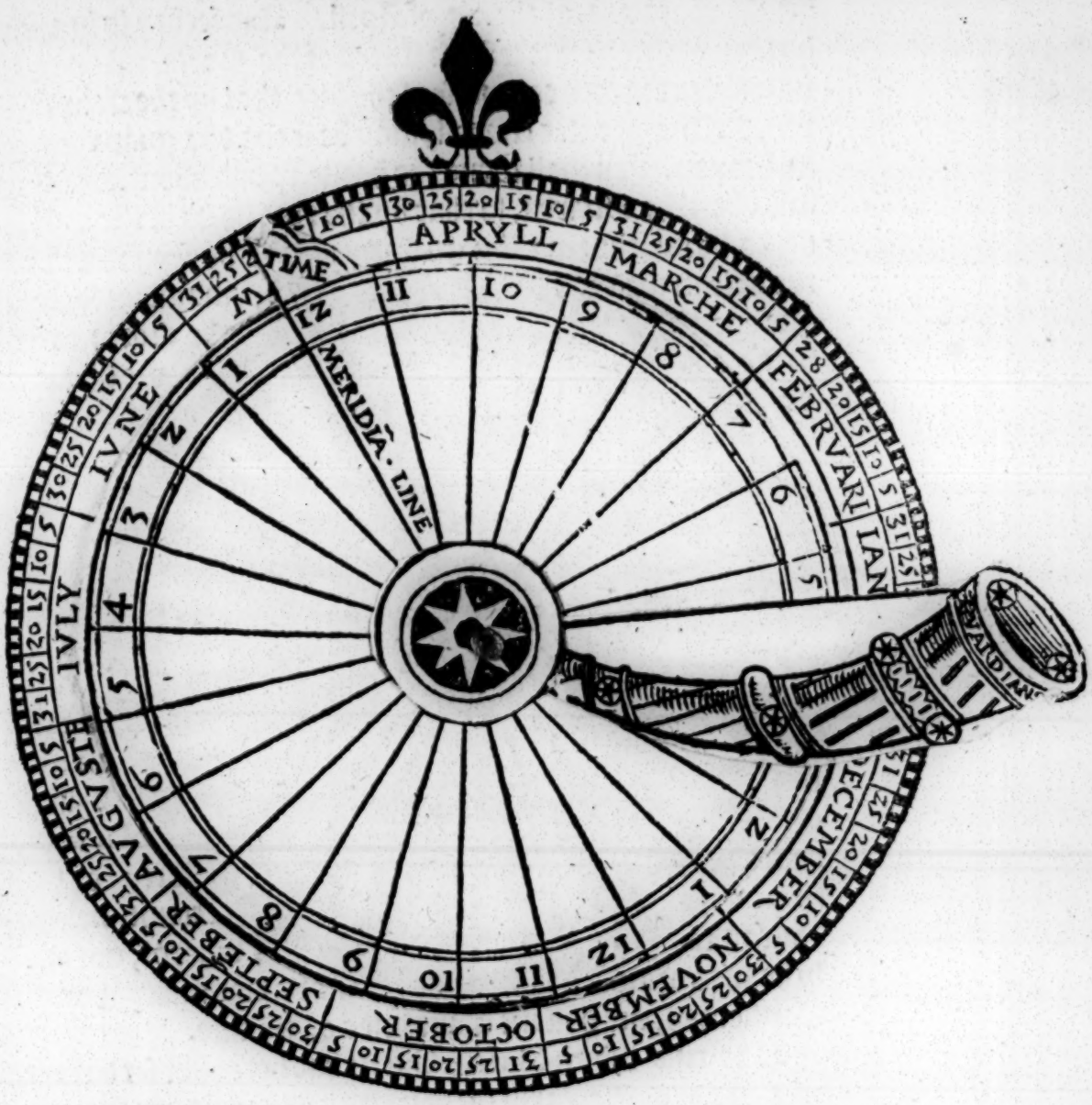
This being done, vpon the outward parte of the great Circle, you shall cut downe the paper passe, or plate of latyn, seauing of the same for a sign or marke, a flower delice vpon the 19 of April, for that it must be the head, & likewise at the 22 of October, may bee left a handle to holde it by. Then must you make a rundell to the same passe or latyn, of the bignesse of the lesse circle, without the circumference whereof, shall be left a tooth or Inder, in the which you shall write, Time. And from the one side of this Inder towards the left hand, you shall draw a right line that may passe through the center to the circumference, and this shall bee the Meridian line. Also to this rundell you shall giue a circle, so much lower from the circumference, that there may bee left a space where the number of the dayes may bee written.

And this rundle you shall diuide into 24 equall parts beginning at the Meridian Line of the Inder, at the twelfth howre of the night. Then in the next space towardes the left hand, you shall make the number of one. Likewise in the second space the number of two, in the third, the number of three, and so forth of the residue, vnto the other twelue of the day, in the opposite or contrary part of the Inder. So consequently proceeding 1.2.3 &c. vnto the twelue of the Inder which shall be the 24 howres of the naturall day.

Furthermore also you must make another peece of the same substance of passe or mettall in maner of a horne, in forme and order as are in heauen, the seauen starres, which make the lesse beare: And this of such quantitie, that the first or formost guarde starre, may reach without the great rundell close to the circumference thereof, hauing the north starre his Center, with the Center of the Instrument. And from this starre or Center vnto the first and formost guard starre must be a right line, by the which the horne must be cut near

from the center, vnto the discouering or shewing of the howres. Also from the first guard to the second, must be two parts of nine, of that that is from the Starre, which signifieth the North to the first guard. Again, the second and last guard must be toward the left hand, ouer or aboue the first, thrée quarter parts of one halfe circle, which hath for the semidiameter the two parts of nine (whereof wée haue spoken before) giuen vpon the right line that goeth from the North to the first guard. These two Guard starres must be boared through with holes, of the bignesse of an Agglet of a point, and likewise the North starre, also with the two rundels through the Center, and by that, all thrée péeces annexed, so that there remaine a hole in the middest, like the holes of the Guardes, so that by it, and by the other of the Guardes, may bée séene the starres in heauen, in such sorte, that the lesse rundell and the horne may be turned round about the Axis, as doth appeare in the demonstration following. This Instrument described as before is said by Martin Curtis, is necessary, saue onely that I thinke it better to place the perpendicular of it the vpper part thereof, on the 25. of April, at which time the formost Guard in these times is precisely vpon the Meridian, aboue the Pole iust at 12 a clocke at night, and the lower part of the saide Diametral perpendicular, to extend to the 28. of October, and béeing so accommodated, you may with much facility vse it after the manner as is after declared.

This



This Instrument thus ended, and brought to perfection, when you desire to know the howre, you shall turne the Index of the lesse rundell, in the which is written Time, to that part of the great rundell, where is marked the day in the which you desire to know the howre, and directing your face toward the North, you shal make the head toward the

height

height of heauen, at the 25 of April. And seeing in heauen by the hole in the middest the starre of the North, holding the instrument in such compasse of the face, that by the circumference of the greater rundell, may be seene the guard starre in heauen, you shall turne the horne round about, vntill it fall vpon the Guards, so that by the two holes of the mouth of the horne, the two Guard starres may be seene, and by the hole in the middest, the North starre, and all three with one eye, then the right line that goeth from the North to the first guard, shall shew in the lesse rundell, the howre that shall be.

CHAP. XVIII.

Of the time of tides, or rising and falling of the Sea.

A Carefull account ought Pilotes and Mariners to haue of the Tides, to take Port, enter vpon Barres, passe by Flattes, and finally, for all manner of Nauigations. For being ignorant hereof, great hurt and inconuenience might chance vnto them, as did of late to the valiant Captaine, Don Iohn Gusman the Earle of Niebla, in the yeare of 1436. who was drowned before the City of Gibraltar, for that the Mariners kept none account, neither had consideration of the Tides. By reason wherof, not onely he was drowned, but also with him died many worthie Gentlemen, and valiant Captaines of Spaine.

The rule which Martin Curtis had hereafter set downe, was made particularly for Spaine, and would not serue for any place, but onely where a North-East, or South-West Moone makes a full sea: And therefore in stead thereof I haue here set downe a generall rule for any point of the compasse whatsoeuer, by which rule as also by the Instrument to that purpose following, knowing the age of the Moone, and what Moone makes a full sea, the tides are found to the very houre & minute ouer all the world, as followeth.

first

first therefore to finde it in the Arithmeticall way, doe thus.

If you desire to know at what howre is tide or high water, in any particular place, learne by some Table, or else by some expert Mariner, what Moone makes a full Sea thereat, as also the howre appropriate to the said point of the compasse, which done, multiply the age of the Moone by 4. diuide the product by 5 and to the quotient, adde the howre which makes full sea in that place vpon the change day, if it excede 12, cast away 12 so often as you may, then the howre of the full sea remaineth, and to euery vnity that remaineth vpon your Diuision, allow 12 minutes, which add to the howres, as if there remain 1, adde 12.'. if 2 adde 24.'. and if 3 adde 36.'. as for example. The Moone being 12. dayes old, I desire to know, at what howre it is high water at London bridge, first, I consider that a Southwest, or North-East Moon, makes a hie water thereat, and 3. of the clocke is the howre appropriate to the point aforesaid: then according to the former rule, I multiply the age of the moon, which is 12, by 4, and it makes 48. then I diuide 48 by 5. and the quotient is 9. and 3. remaineth, which added to 3, makes 12. howres, 36.'. therfore I conclude that the moone 12 dayes old, the tide is at 12 of the clocke and 36.'. at London bridge, or in any place, where the like moone makes full sea. Againe, at Erith, a west, south-west, or an east, north-east moone makes full sea, and the howre appropriate is 4, howres, 30.'. the moon 26. dayes old, I desire to know the howre of the full sea: first I multiply 26. the age of the moon, by 4, makes 104, which diuided by 5, the quotient is 20, and 4 remaineth, which added to 4½, the howre when the sunne is vpon the said point of the compasse, & it makes 25 houres 18.'. from which I take away 24, which is 2. times 12, and there resteth one howre, 18.'

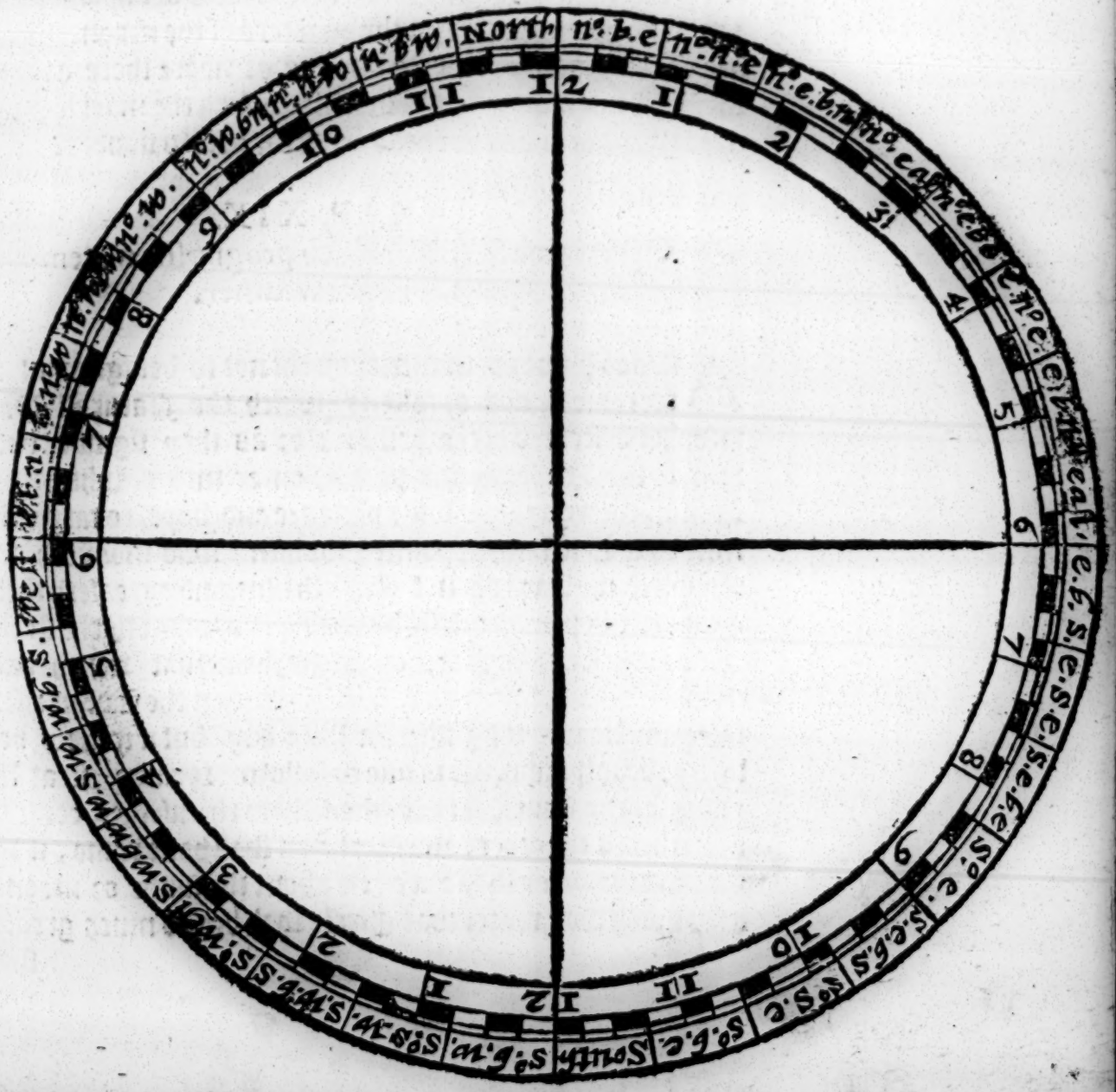
And the better to vnderstand the increasing & decreasing of the Ocean Sea, it shal be conuenient to know the cause thereof, whereunto we say, that the moone is the cause of ebbing and flowing, or rising and falling, increase or decrease

decreaſe of the ſea: not onely by her light, but alſo by her ſecret or hid property. The Moone compaſſeth about the earth, from the Eaſt into the Weſt, vntill ſhee returne to the place or point from whence ſhee departed, and in this courſe waſteth or ſpendeth ſo much more then one Naturall day, in how much her proper mouing is more then the Sunne againſt the firſt mooueable, ſo that ſhee maketh her turne or courſe about the foure quarters of heauen, in 24. howres, and foure fifthes of one howre, which are the 12. degrées that ſhée goeth more then the Sunne. And in this time the Ocean encreaſeth and decreaſeth twiſe, ſo that this encreaſing and decreaſing, anſwereth directly to the courſe of the Moone, whereby it followeth, that the ſea increaſeth fiue howres and one fift part, & decreaſeth other fiue houres and one fifth. And if this day at the twelth howre, was full ſea, the low water ſhal be at the firſt howre and one fift part: and at the twelfth howre, and two fift parts it ſhall retuone to be full ſea, and at the firſt howre and thrée fifthes ſhall bée low water againe, and at the twelfth and foure fifthes of the other day ſhall bée full ſea: ſo that from one day to another the tide doth ſhorten foure fifthes of an howre, which is the time that the Moone tacketh or tarrieth more then one naturall day, to returne to the point from whence ſhe departed by the twelue degrees, whereof we haue ſpoken Whereby it manifeſtly appeareth, how they begnile themſelues that ſay, that the ſea encreaſeth 6 howres,, and decreaſeth other 6. For if it were ſo, the tides ſhould euer be at one ſelfe ſame time and howre: but forаſmuch as there is more then 24 howres, by the ſaid 4 fifth parts, thereby is cauſed the variation of the tides ſo that if this day, the tide bee at one of the clocke to morrow it ſhall bee at one and 4 fifth partes, and the day following, at two of the clocke and thrée fifthes.

The Inſtrument following ſheweth what howre is appropriate to any point of the compas, the vſe whereof is as followeth, knowing what moon makes a full ſea, lay the third to that point of the compas, then turn the inder of the moone

till

till the day of her age come full vnder the threed, and then the howre which the Inder of the Moone cuts, is the howre of the full Sea. As for example, Being in London where a South-west, or a Northeast Moone makes high water, and the Moone fiue dayes old, I desire to know at what time it is full sea the same day: first I lay the threed vpon the south west point, then I turne the Inder of the Moone till the first day of her age come right vnder the threed, and I finde that the Inder of the Dials the howre of 7. and 48'. which is the time proposed.



Béeing at Graues end, where a south south west moone makes a full sea, and the Moone 18. dayes old: to finde the howre of the Tide, I lay a threed vpon the south south west point, and turning the Index of the Moone till the 18 day of her Age come vnder the threed, and then the Index of the Cuts almost 4. of the clocke, at which time, is the tide to go from Graues end, vpon the day proposed.

This increasing and decreasing of the Tides, is not euer in equall quantity. In the Coniunctions and Oppositions, they increase and decrease much, which the Mariners call high spring tides, and the greatest of all, they call the high springes. In the quarters of the moone (which are at the 7. and 22. of the Moone, or neare there about) they increase and decrease but little: which the mariners call nepe tides, low waters, dead waters, or low floudes.

CHAP. XIX.

Of certaine Signes, which prognosticate tempests, or faire weather.

A Good Pilot or mariner, ought not to bee ignorant of certaine signes or tokens, which the Naturall Philosopher described of tempests: For as they signifie vnto him, so shall he leaue his port, or enter into it, which if hée cannot, then ought he with patience and hope, to tarry the time that God hath appointed for him, who mooueth and troubleth the seas when it pleaseth him, and appeaseth them again at his pleasure: lesse hurteth and damageth the stroke which wée see comming, or foresée, then that which hath stricken vs, and taken vs carelesse. When the Sunne riseth faire and cleare, it signifieth a faire day, but if it shew yellow or deadly, tempest is like to follow. Againe, if at the rising of the sunne, his beames shew themselues contract or gathered together, and short, you shall haue raine, if the mistes or cloudes make a circle about the sunne or moone, how much the greater that Circle shall bee, so much greater

shall

shall be the tempest to come, and if there shall be two circles the tempest shall increase the more. And if it chance, that at the rising of the sunne the clouds be turned redde, it is a signe of no small tempest. When the sunne or the moone shall haue a circle, looke toward the part where it breaketh, and from thence shall winde come, if it depart, or disperse equally faire weather shall follow. When the moone riseth bright, and shining with pure colour, you may iudge it faire weather: and if red, winde, if blacke raine. When in the new moone, the hornes or corners appeare grosse or great, it is a token of tempest, and if sharpe, it signifieth faire weather.

This that we haue said, is the authority of Plinie, and Aristotle, to whom the prudēt mariner shal giue credit, vntill he haue found other more certaine, eyther by his owne experience, or by the experience of other Wise men, worthie to be beléeued. And euery man ought to trauaile as much as in him is, for the knowledge of these thinges, according as God hath giuen him vnderstanding and reason to appoint the same; and this shall be wisedome, bearing in memory the experience of things past, to gouerne presently, and to prouide for things to come. The prouidence of God is so great that depriuing brute beastes of reason and vnderstanding, he hath giuen them sense and naturall instinct, whereby they may know that, that men doe vnderstande by reason.

By this sense and secret Instinct of Nature, the Ants or Pismires, with prouidence and diligence, lay vp in store their prouision and Egges, when before they féele the raine to come. The Swallowes also when they feele the Winter comming, passe the seas. Likewise the Fishes when they perceiue stormes to come, goe downe to the bottome of the water, and hide them in the mudde of the sea. And although it may séeme beside my profession, to meddle with matters pertaining to Diuines, yet wil I not omit to speake that Christ our Lord saith, as testifieth Saint Mathew. When the Pharisies with the Saduces (to tempt him) willed

led him to shew them signes from heauen, hee answered saying, When it is Euening, you say it shall bee faire weather, because the heauen is red, and in the Morning you say it shall bee tempest, when yée see that the heauen draweth toward redde, &c. They knew by that they iudged of heauen to determine thinges to come, as whether it were euill to take iourney, to enter the sea, to reape corne, to lay it abroad, or to gather it in. I say, that to vnderstand the reason that mooued them to haue such consideration of time, (which wée now likewise obserue) it is necessary to know that the red colour which appeareth in the Euening, signifieth the drinesse of the ayre, whereby the matter of the grosse vapours which should be conuerted into the Water, is so much dried, that it appeareth in manner inflamed, and is therefore red, and so is it not aptly disposed to bee conuerted into water, and is therefore the neerest signe of fayre Weather. The other signe, when the heauen in the morning draweth toward rednesse (yet not redde) sheweth manifestly, that raine shall follow. Whereof the cause is, that this matter is ingrossed, because this Colour cannot bee but in grosse and thicke matter, which is not dried, and therefore is not redde, as the cloudes that appeare in the west, in the time of fayre weather: but it is a matter somewhat troubled, and partly red, and is therefore a confounded matter, which touched with the heate of the Sunne, and herewith broken and dispersed, falleth downe, and is conuerted into water. And further, as touching the said troubled or grosse water, I say, that the drie and ruddie part thereof, is eyther turned into winde by drinesse, or else béeing compassed about, and enclosed with moist matter, is altogether conuerted into raine, and so maketh tempest. For by tempest is meant not onely rayne, but also tempestious winds with water.

Likewise it is written by Saint Luke: When you sée a cloud rise in the West, you say raine shall follow, and when the winde bloweth South, you say it will bee hote, &c. To vnderstand this, I say the cause of this is, that raine is made

or engendred of moist vapours, which both may be and are ingrossed, or otherwise, a cloud is a grosse body of moist vapours, so engrossed, and when the cloud doth so rise, it shall bee a signe that raine shall shortly follow, for that that was engrossed in the cloud, shall some be resolued into water. To the other reason, why they say, that when the winde bloweth south, it will be hote: I say that that wind is hote and drie. Furthermore it is to be considered, that the windes are sometimes drie, and sometimes moist, yet not by their owne property, but according to the Regions by the which they passe. Wee see that in some one Region it raineth with one wind, and the selfe same Wind in other places disperseth the cloudes. The Northwest wind is drie in Spaine, yet in Libia it is very moist and rainy. The South winde in Europe, causeth raine in most places, and therefore the Poets named it the Winde of Waters, and this Wind in Palestina or Iurie is drie. The cause of this diuersity is, that when the wind bloweth in Palestina, it passeth by hote and drie regions, as by the desarts of Affrica, and passeth not by any sea at all. But when it bloweth in those parts of Europe, it must of necessity passe by, and ouer the waters of the sea Mediterraneum, or the Leuant Sea, where it gathereth moisture, and causeth raine. The Leuant or East wind in Malaga and Gibralter, is moist, and in Sheres De La Frontera, is hote as Hell.

CHAP. XX.

Of the bright and shining exhalations that appeare in the tempests, which the mariners cal Santelmo, or Corpus sancti.

IGnorance is the mother of errours, and therefore will I not omit to shew the naturall cause hereof, although among certaine simple and ignorant people, it is acounted for a miracle, that in certaine tempests on the Sea, the Mariners see certaine shining and bright fires, which with great

superstition they kneele downe vnto, and pray vnto, affirming that it is Santelmo that appeareth vnto them and not contented herewith, some sweare that they haue seene drops of greene ware fall downe: Other affirm, that this ware is of such heate, that if it fall from the toppe of the shippe, it doth melt the Rozen, and pitch of the hatches of the shippe, with such other foolish imaginations, and therefore it shall be good briefly to speake hereof, to stoppe the mouthes of such fond and ignorant persons. The exhalations or vapours of the grosse fumes or smoakes that rise from the earth, are constrained or gathered together by the coldnes of the night, and the ayre, and thickned in the first Region of the ayre, next vnto the earth. This may, and is wont to bee enflamed or kindled, and if it finde a body whereunto it may cleave, it abideth in that vntill it be consumed. This fire is cleare and shineth, and yet burneth not. The Grekes call it Polyduc s, and the Latines call it Castor and Pollux. It is accustomed to appeare vpon the shrowdes, and oftentimes is seene vpon the pikes of Souldiers, in the armies of men of warre, as Plinie writeth, and this, aswell by reason of continuall smoake, as also by the heate of much people. Certain it is, that smoake is none other thing then fire dispersed, as flame is an exhalation or euaporation that riseth in manner of smoake, from a grosse or fat body, and at the time that it riseth, being gathered together, is constrained into flame, inuestured with fire. This resplendence or shining, is also oftentimes seene, not onely in iourneying by land, but also in sayling by riuers, and when it appeareth [illegible]e land, it riseth of the smoake that is gathered together with the colde ayre of the night, and on the bankes of riuers: this smoke is gathered of the exhalations of the Water, and consequently, being kindled, appeareth bright and shining. But now let vs come to the Shippes that sayle by the Sea, and to the Mariners that are accustomed to tempests. To them therefore (I say) that that light or such other lightes as they see, is engendered of the fumes and smoakes of

their

their Shippe with the heate of men couched close and neare together in a narrow place, and when a tempest riseth the saide smoake is thickned, prest together, and beaten downe by the windes in such sort, that beeing tossed from one side to another, it is set on fire by mouing, and taketh hold sometime on the shroudes, and sometimes on the toppe and sometime also in the poupe, or in the foreshippe: so that to see this light, or the same to appeare, is a naturall thing, and not supernaturall.

When Captaine Bezerra was at Cozon in the Emperours Nauie, with his Company of Souldiers, hee chaunced to bee in a tempest, and saw the said fire of Santelmo, which shortly after descended so low, that the Captaine might easily come to it, and taking it in his Cloake, hee found it to bee a little droppe of Water. Some haue thought it to bee a certaine shining Flie, called Taros, which the Seamen sometime see in a calme in the Summer season: and thus Santelmo appeared no more. The Captaine remained astonished at the mockerie, and the other perceyued it to be no miracle. The opinion of the Mariners that affirmed it to be Santelmo may rise of Saint Erasmo, Bishoppe of Naples (who as they say) not onely in his life time, but also after his death, was a patrone and helper of Mariners, that called vpon him in tempests. This name of Erasmo, they of Naples call Ereemo: and processe of time taking away one e by the figure of Sincope, remained the name of Santermo. And the Spaniards, who neuer can long keepe any strange vocable, call it Santelmo, turning r into l. Yet of this Santelmo, whereof the Mariners speake, there is neither scripture that maketh mention, nor authority that confirmeth it. I heare say that the Fryar Preachers had a religious man of commendable life, and good conuersation, named Fryer Pero Conzales, borne in Galizia, and that in his life time, our Lord did certaine miracles by him, and that this is hee that shineth and giueth light in tempestes. No doubt

but GOD worketh miracles in his Saintes, and by his Saintes, as saith Dauid. But if this seruant of God, was Perá Gonzales, how then shall hee bée Santelmo? Another difficultie there is, as touching this light: for there are Writings of more antiquity then the law of grace and comming of Christ in flesh, which giue testimonie hereof. For the Poet Virgil in the second of his Aeneidos writeth, that this fire appeared vpon the head of Iulius Ascanius: And Titus Liuius in his first booke, affirmeth, that it appeared vpon the head of Seruius Tullius, the first King of the Romaines.

Pomponius Atticus sayth, that Rome beganne to bée builded in the third yeare of the third Olimpiade, that is in the tenth yeare of Ionathan king of the Jéwes, and from the Creation of the world 3201 yeares, and 729 yeares before Christ our Sauiour was borne. The Kings of Rome were seauen, and raigned 244 yeares. Eusebius saith, they raigned 246. Seruius Tullius raigned 44 yeares, Tarquinius Superbus 25 yeares after him. So that discounting these yeares, it shall appeare clearely as I say. Although the yeares were not discounted, let them reade Diodorus Siculus, an ancient writer, let thē read Plutarchus, Aristotle, and other olde Authors that haue written hereof, and they shall finde, that if tempests be neare vnto the sea, these fires and lightes appeare in them, and appeared not onely to the Gentiles, but at this day also appeare to the Turkes and Moores in tempests, when onely one light appeareth, it is taken for an euill signe: And hereof saide Propertius thus.

Candida fœlici solute vela toro.

And why it is an euill signe, this is the cause, that if the tẽpest that riseth be great, it choketh the exhalation, although yet by the part least troubled, it appeareth. When there are 2 lights, it signifieth that it is sufficient to consume the matter of the tempest, or that the tempest beginneth to cease, and the grosse humour hath the Masterie. But sometimes it

it chanceth that two lights appearing, there may be a tempeſt, and one appearing ſhall not be ſo great, and oftentimes there is a tempeſt without any light at all ſeene. The blind Gentility called theſe Caſtor and Pollux, and placed them in heauen in the ſigne of Gemini.

Now remaineth to aunſwere to one obiection of the Mariners, who ſay, that neuer man that hath ſeene theſe Fires hath periſhed. To this I ſay, that many may ſee, and haue ſeene theſe lights, of whome, ſome haue béen in perill, and ſome drowned: Notwithſtanding, no man can affirme, that if the drowned might ſpeake, they would ſay that they haue ſeene them. Therefore the wiſe Chriſtian Mariner ought to haue a cleare conſcience, and to call for the helpe of Almighty God, lifting vp his eyes and handes vnto Heauen and ſay with the Prophet, Saluum me fac Deus, quoniam intrauerunt aquæ vſque ad Animam meam: Saue me, O my God, for waters haue entred euen vnto my Soule.

Here endeth the ſecond Part.

THE THIRD PART
Entreating of the compoſition and *vſe of Inſtruments, and Rules* for the Art of Nauigation.

CHAP. I.

Of the Number, Order, and Names of the Windes

EOLVS King of the Eolus Ilands or Ilands of Vulcan, was ſo greatly eſtéemed for hauing reaſon and knowledge of the windes, that they of auncient time called him the God and Lord of them: with no leſſe conſideration the prudent Mariner ought not to bee ignorant of them, foraſmuch as the vniuerſall benefite and commodity of Nauigation conſiſteth therein: and to haue the better knowledge therof, you ſhall vnderſtand, that wind is a fruit of the Ayre, and a vapour of the earth, the which by reaſon of his ſubtilety, pierceth the ayre, ſtriketh it and enforceth it. Other ſay, that winde is ayre, moued or toſſed by the vehement influence of vapours of contrary quality, it is in Latine called Ventus, becauſe it is vehement and violent; whoſe force is ſo great, that it ouerthroweth not onely heapes of ſtones,

stones or rockes, and casteth downe trees, but also disturbeth the ayre and the earth, and moueth the seas. There are foure principall windes, which come from the foure Cardinall or principall points of the Horizon. We haue saide that the Meridian Circle cutteth the Horizon in two points (that is) in the North and in the south, and the Equinoctiall entreth it in other two, that is in the east and west: & from these foure pointes come these foure windes, whereof all the whole Scripture maketh mention. These foure winds, they in auncient time, named in this maner. That that commeth from the East, they called Subsolanus, which wee call the Leuant or East wind. That commeth from the South, they named Auster, which we call the Meridian or South wind. That commeth from the West, they cal Fauonius which we call the Ponent or West. That from the North, they named Septentrio, or Aquilo, or Boreas, which wee call North. To euery one of these foure Windes, they adioyned two collaterall windes, in manner as followeth: That, that is from the East toward the part of the North, where the Tropicke of Cancer ariseth, or commeth foorth, they called Vulturnus: and that that is from thence toward the part of the South, where riseth the Tropicke of Capricorne, they called Eurus, also that is from the West toward the part of the South, where the Tropicke of Capricorne goeth downe, they call Aphricus, and that that declineth to the North, where the Tropicke of Cancer goeth downe, they call Caurus. The Collaterals of the North and the South, aunswereth to the Circumferences of the Polar Circles, that that is from the North towards the Leuant or East, they call Aquilo, and that declineth toward the West part they call Circius, that is from the South toward the East, Euro Auster, and towar the west Euro Aphricus: thus many hath Aristotle in his Metheora. With these twelue Winds they sayled in old time, and made their compasse by them.

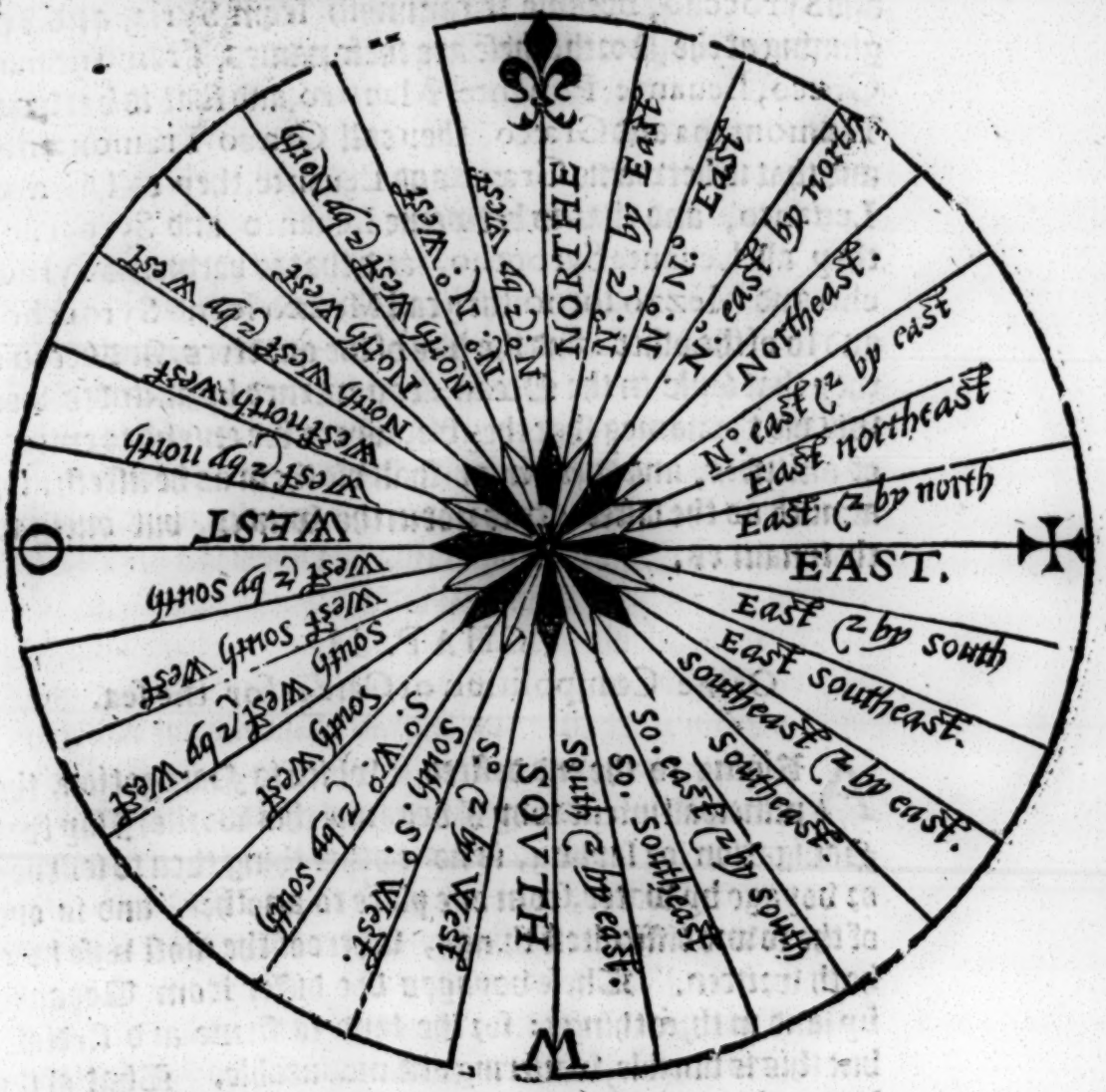
The Hydrographers of late daies, and such as are tra-

uailed and exercised in sayling, agrée with the Ancients, in the foure principall windes, although they haue changed the names, calling the Leuant, or Orient, East, the Ponent or Occident, West: the Septentrionall, North, and the Meridionall, South. Betwéene these foure Windes, they diuide euery quarter of the Horizon into two halues, made of the two neareſt, in this manner. Betwéen the North and the East, taking name of them both, they named the north-east. Betwéene the East and the South, they name the South-east: and betwéene the South and the West, South-west. betwéene West and North, Northwest. These eight windes in Nauigation, they call wholewinds.

Betwéene these eight windes, they place other eight that are called half winds, which also are named of the two, that are neareſt vnto them. That that is betwéen the north and North-east, they call North, North-east: Betweene North East, and it, East North East, and so foorth of the other. Beside these halfe windes, they haue other which they call quarter windes. These take the name of the winds to the which they decline: as if to the quarter from the north toward the North-east, they call it North, and a quarter toward the North-East, that is North and by East. And that that is toward the Northwest, they call North, and a quarter toward North-west. And so of the other, as shalbe verified in the Figure following, whereof is gathered, that deuiding the eight principall windes into halfe windes, they are 16. And euery halfe winde deuided into two quarters, are in all 32 windes. Some haue béene so curious, or rather so vainely carefull, and too precise, that they haue diuided them into 64. And in the Cards that they haue, the confusion of lines is greater, then the profit that may be taken thereby.

The

The Demonstration of Winds.



These names doe they vse that sayle by the Ocean Sea, And it seemeth they had their beginning of the Almaine or Flemish tongue, for these nations chiefly sayle in the Ocean. They that sayle in the sea Mediterraneum, or Leuant sea, call them by other names, taking originall of the Tuscan or Italian tongue. Or else that they haue denomination of the parts from whence they come, in respect of the Sea Mediterraneum, as the wind called Græco, because it commeth from

from Grecia and Libeico, because it commeth from Lybia, and Syroccho, because it commeth from Syria, and beginning at the North, these are their names, Tramontana, Græco, Leuante, Ponente, Maestro, and that is betwæn Tramontana and Græco, they call Græco Tramontano, and that is betweene Græco and Leuante, they call Græco Leuanto, and that is betweene Leuanto and Syroccho, they all Leuante Syroccho, and that is betweene Syroccho and Mezzo Iorno, they call Mezzo Iorno Syroccho, and so of the other: and the like of the quarters. And because they that sayle in the Ocean, are gouerned by altitudes, wee will vse the names that they vse, where we entend to entreat of altitudes, and euery man shall vse them as he listeth, for asmuch as the difference is not in the windes, but onely in their names.

CHAP. II.

Of the Composition of Cardes for the sea.

ARiuing to the end desired (which is Nauigation, the principall intent why I beganne this worke) I say that Nauigation or sayling, is none other thing then to iourney or voyage by water, from one place to another, and is one of the fowre difficultest things, whereof the most wise king hath written. These voyages doe differ from Voyages by land in thrée things: for the land is firme and stedfast, but this is fluible, wauering and mooueable. That of the land, is knowne and termined by markes, signes, and limits, but this of the sea, is vncertaine and vnknowne. And if in Voyages by land, there are hilles, mountaines rocks, and craggie places, the sea payeth the same seauen fold with tormentes and tempests: therefore these Voyages being so difficult, it shall be hard to make the same vnderstoode by wordes or writing. The best explication or inuention, that the wittes of men haue found for the manifesting of this is to giue the same painted in a Carde.

For

For the draught, or making whereof, it shall be requisite to know two things; whereof the one is, the right position of places, or placing of Countries and Coasts. The other is the distances that is from one place to another, so the Card shall haue two discriptions. The one that answereth to the position shall be the windes, which the Mariners call lines or pointes of the compasse: and the other that answereth to the distances, shall bee the drawing and pointing of the coasts of the land, and of the Ilands compassed with the sea. To point the windes or lines, you must take skinnes of Parchment or large Paper, of such bignesse as you will the Carde to be, and in it draw two right lines with blacke inke, which in the middest shall cut or diuide themselues in right Angles, the one according to the length of the Carde, which shall bee East and West, and the other North and South. Upon the point where they cut, make a center and vpon it giue a prity or hid circle, which may occupie in manner the whole Carde. This Circle some make with lead, that it may easily be put out: these two lines diuide the Circle into foure equall parts, and euery part of these shall you diuide in the middest with a pricke or point. Then from one point to another, draw a right Diametrall line with blacke inke, and so shall the Circle remaine diuided with foure lines, into eight equall parts, which correspondo to the eight windes. In like manner shall you diuide euery of the eight into two equall partes, and euery part of these is called a halfe winde. Then draw from euery point to his opposite Diametrall, a right line of greene or azure: likewise shall you diuide euery halfe winde in the Circle into two equall parts. And from these pointes which diuide the quarters, you shall draw a certaine right line with redde inke, which also shall passe by the Center, which they call the mother Compasse, or chefe Compasse of the Carde, being in the middest thereof, and so shall come forth from the Center, to the circumference, 32 lines, which signifieth the 32 windes. Beside these said lines you shall make other

equall

equall distant to them, and of the selfe same colours, in this manner. From the points of the winds, and halfe windes that passe by the Center, draw certaine right lines, that passe not by the Center, but be equally distant to those that passe by the Center, and of the same colours and equidistance, as are they that passe by the Center. And as these lines concur together aswell in the Center, as in the points of the winds, and halfe winds, that are in the circumference of the Circle, they shall leaue, or make there other sixteene Compasses, euery one with his thirty and two windes. And if the Carde bée very great, because the lines may not goe farre a sunder, if you will make there other sixteene Compasses, you must make them betweene the one and the other of the first sixteene points, where the quarters are made with their winds as we haue said. It is the custome for the most part to paint vpon the Center of these Compasses a flowre, or a rose with diuers colours, and gold, differencing the lines, and marking them with letters and other markes, especially, signing the North with a flowre Deluce, and the East with a Crosse. This beside the destinction of the Windes, serueth also for the garnishing of the Carde. And this for the most part is done after that the coast is drawne. And thus much sufficeth for the draught of the winds.

The situation of the places, Ports and Ilandes in the Carde, according to their proper differences, consisteth in the particular, and true relation of such as haue trauailed them, and therefore for this purpose it shall bée néedefull to haue patterns of coasts, ports and Ilands, which must be painted in the carde, and these of the best and most approued to bée true, and not onely to haue patternes well painted, but also it shall bee necessarie to know the true Altitudes of the Pole, of certaine principall Capes, Portes and famous Cities. This done, they must bée translated into certaine thinne papers, and transparent that may bée séene through, and those of the best and finest that may be had, annointing them with oyle of Line-séed, and then drying them at the Sunne. Then take

take the patterne or Card that is to be translated, and reach or stretch it forth vpon a Table. Then put the transparent paper vpon the one side of the patterne where you will beginne. And the paper beeing made fast vpon the patterne with plomets of lead, or a little ware, that may easily be taken of, you shall in the transparent paper marke with a fine penne, one East and west, and one north and south, or two, vpon those that are séene by the selfe same Paper in the patterne. And this is called tracing or translating. In like manner shall you trace all the Coastes, Hauens, Ports, Ilands, Cities, Capes, and riuers, as appeareth in the patterne, vnto the rockes that come forth of the water, and the knowne bankes. And because this paper doth not suffice, you shall put thereto another, and more as néed shall require. And beginne the translation in one, where the other endeth, vntill you haue translated all that you desire, not forgetting to make in euery one, lines of North and South, East and West, to serue for markes afterward. So that the line of North and South, of the one paper, may ioyn close and euen, with the line of the North and South of the other paper that is ioyned to it by longitude.

And the paterne thus translated into these papers, you must put the ruled or lined paper or papers vpon a playne, smooth and stedfast table, where you shall stretch them forth & make them fast with plomets or weights, or nayle them to the table by the sides or corners with small nayles. Then vpon the said ruled paper, you shall put the paper that is translated from the patterne, in that side or part that is correspondent from the patterne to the ruled Carde, so that the lines of East and West, North and South of the translation, may bee vpon the lines that aunswere to them in the ruled Carde.

This paper thus made fast by the one side or part, you shall by the other side (that it may remaine in his place) put vnder it an other fine paper, smoaked or smyred on the neathermost part (which is that, that falleth vpon the ruled carde)

carde) either with a lincke, or with matches of pitch. These thus ordered, and made fast one vpon another, you shal make a steele bodkin or wyre with a smooth and blunt point that it race not, or bore not the paper, and with it shall you draw pressing vpon all the translation, and tracing it with diligence and discretion, marking euer how much in it is translated from the patterne, sauing the windes or lines which the Mariners call Rumbos, and so shall remaine all the impression of the smoake in the ruled card, vpon the which with a fine penne, you shall trace with inke, which being drie, you shall with crummes of bread make it cleane from all the smoake, and so shall the coast appeare in the Card drawn with inke.

This done, then with a small penne shall you describe in the Carde, all the places and names of the coast in that part where they are, and as they are seene in the patterne. And first you must describe in redde, the Portes, principall Capes, famous Cities with other notable thinges, and all the residue in blacke. Then shall you draw or paint Cities, Shippes, Banners, and Beastes, and also marke the Regions, and other notable things. Then with colours and golde shal you garnish and beautifie the Cities, Compasses, Shippes and other partes of the Carde. Then shall you set forth the coasts with greene, by the shore or bankes of the landes, and make them fayre to sight with a little Safron or otherwise, as shall seeme best. Likewise shall you describe certaine letters with their significations in this manner.

B for a Bay, C for a Cape; A for an Angle, I or Y for an Iland, M for a Mountaine, P for a Porte, R for a Riuer.

Then in place where is more roome, or that is least occupied, you shall draw two right lines, equally distant, and the one no further from the other then halfe a finger, or little more, and so long that betweene them may be marked at the least three hundred leagues. And this the Mariners call the

trunke

trunke or scale of leagues, and place it or vse it in this manner. They take with the compasse a hundred leagues of the trunke of the Carde or patterne that is translated, and they set them iust betweene the two lines, and this space they parte by the halfe, and rest the foote of the compasse in 50, and these diuided againe equally in two parts, they rest the compasse in 25, and the 25. being likewise diuided, they rest in 12. leagues and a halfe, and marke them as hereafter shall be declared.

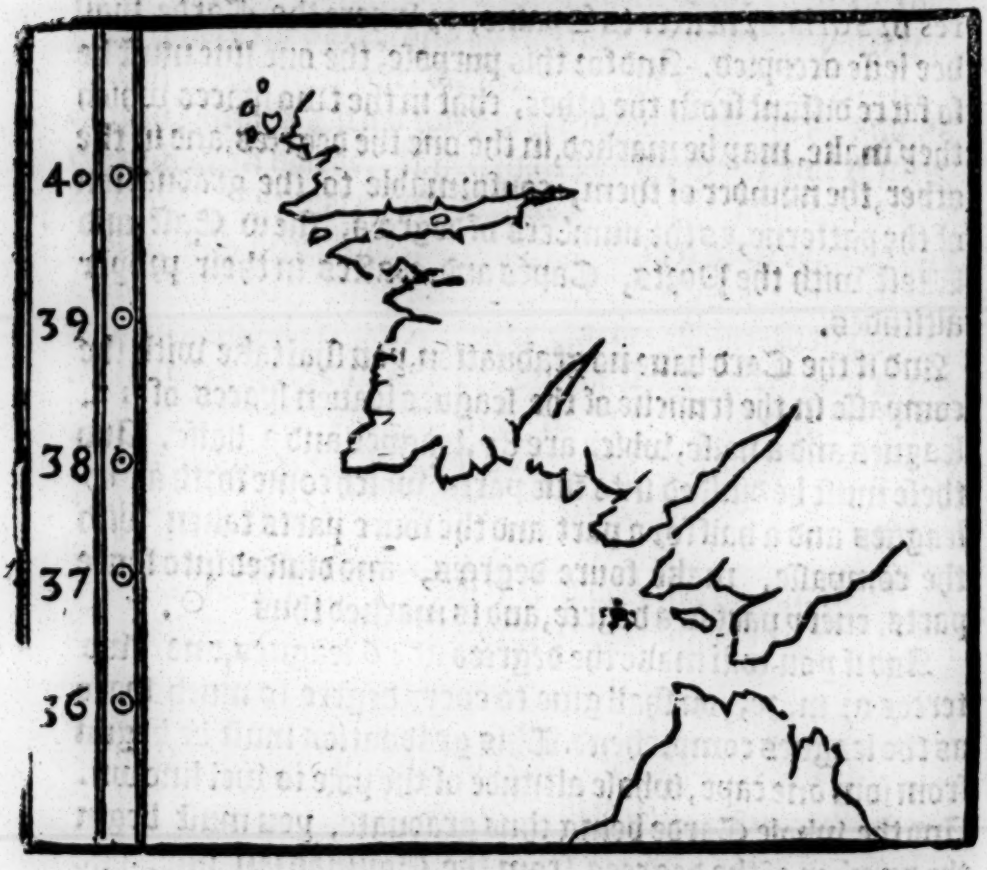
The Carde being thus made, then to graduate it, or diuide it into degrées, you must draw three lines, which make right Angles with the line of East and West, equidistant to the line of North and South, and they also shall bee North and South. These shall be drawne by the Ilands of Afores or Soria, or nearer to Spaine, or where the Carde shall bee lesse occupied. And for this purpose, the one line must be so farre distant from the other, that in the two spaces which they make, may be marked, in the one the degrees, and in the other, the number of them, conformable to the graduation of the patterne, as the numbers of degrees, shew East and West, with the Ports, Capes and coastes in their proper altitudes.

And if the Card haue no graduation, you shal take with the compasse in the truncke of the leagues seauen spaces of 12. leagues and a halfe, which are 87. leagues and a halfe. And these must be diuided into fiue parts, which come forth at 17 leagues and a half for a part, and the foure parts taken with the compasse, make foure degrées, and diuided into foure parts, euery part is a degrée, and is marked thus ⊙.

And if you will make the degrées at 16 leagues, and two terces or more, you shall giue to euery degree so much space as the leagues comprehend. This graduation must be begun from som one cape, whose altitude of the pole is wel known. And the whole Carde being thus graduate, you must begin the number of the degrees from the Equinoctiall line, one two, three, &c. toward the one Pole, and the like toward the other

other: so that to the knowne Cape, may answere the number of his altitude. And so shall you doe to the whole carde. Also the Equinoctiall line shall bee marked in his proper place.

And in like manner shall you marke the Tropickes according as they are in the Spheare. But forasmuch as in Spaine, Cape Saint Vincent is the principall, they begin there to make graduation and number it in 37 degrees: and from thence toward the pole artike, the degrées do increase, & from thence toward the Equinoctiall line, they diminish, & from that line to the Pole Antartike, they encrease againe, (as we haue said) as is contained in the Carde, and as appeareth in this demonstration following.



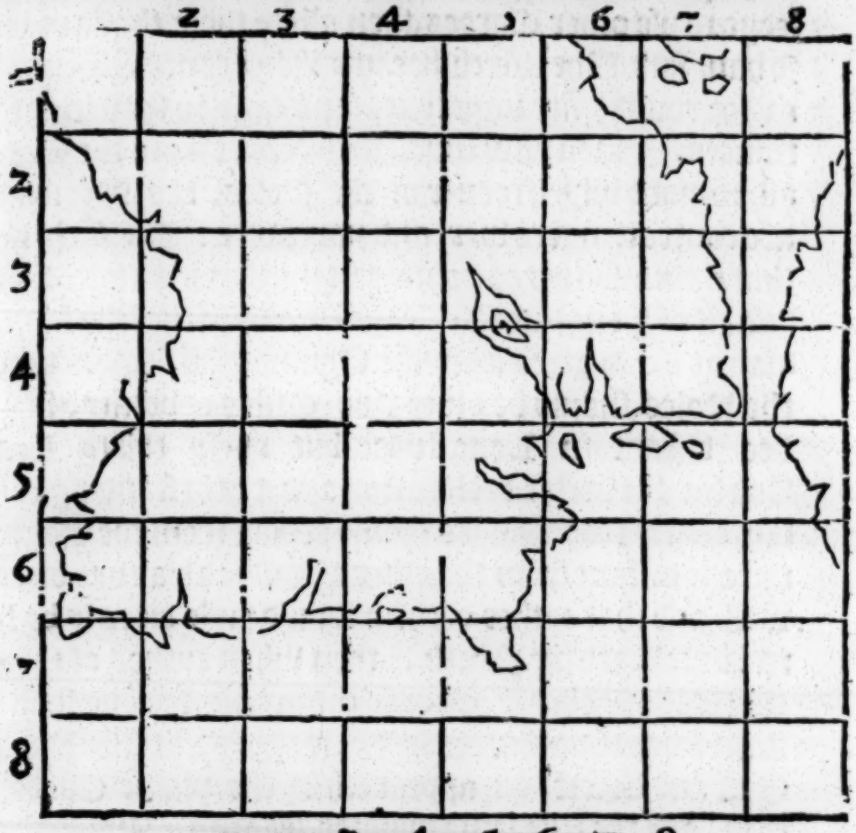
And if the patterne haue neither leagues nor degrées,
you

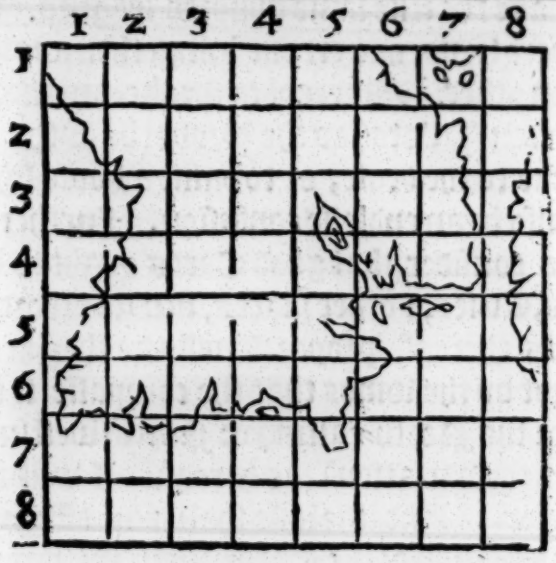
you must take or know the altitudes of two Capes, that are North and South, of the degrées, and the difference of the degrées of the elevation, that is from the one cape to the other, yée shal divide all that space in so many parts, and so each one part shall be 20. English leagues, or 17. leagues and a halfe, as answering to one degrée. Or according to the opinion of the leagues of the roundnesse of the earth, as we have said, as touching this in the 18. chapter of the first part. In Spain they use with the Compasse to take the space that is from Cape Saint Vincent, to the middest of the greatest Iland of Birlinga, which they account three degrées: so that after 17. leagues and a halfe for a degrée, they are 52. leagues and a halfe, and so much doe they put in this space. Other put 50. leagues, accounting after 16. leagues, and two tercos for a degrée: and in this manner they make of leagues, degrées, and of degrées, leagues. The sayling Cardes have no certain bignesse limited them, because they onely represent the Description of the water and earth, and not the quantity, and for this cause some are pointed in great space, and other in little. They that are in great space, are more manifest, and more precise: and these the Mariners call Cardes of the largest pricke or draught. Some desire rather to have them in lesse space, because they are briefer, and containe much in little roome, and these they call Cardes of the lesse pricke. And if for any consideration aforesaid you desire to reduce any carde from the greatest pricke to the least, or contrariwise, you must paint onely the Coast and Ilands on a paper, in manner as you did in the ruled Carde, of the lines or windes, I say, let it be drawne upon paper, for destroying or racing the patterne. And when it is traced onely with inke, then uppon that Draught shall you draw certaine right Lines equally distant, made all by one Compasse, according to the length of the Carde, and other Lines that may cutte them in right Angles. And likewise Equidistant, and of the same Compasse that the first are. These two Orders of Lines, shall divide all the super-

ficiall part of the Carde into perfect squares or quadratures. And it is to be noted, that the nearer the lines are ioyned together, and the squares the lesse, so much the more perfectly may it bee reduced, and more easily. Then shall you take another paper, greater or lesse then the Carde, according to the point that you desire to reduce it vnto, and in the length and breadth thereof, you shall diuide so many spaces as are betweene the lines of the other paper, and if it be greater, the squares shall be greater, and if lesse, lesse. To keepe order in the correspondence of the squares (which shall be a great light to translate the one from the other) you shall number the orders of the squares, as those of the longitude, by the front or vppermost parte: and those of the latitude by the side, aswell in the one paper, as in the other, conformable: also, those of the Front, from the left hand to the right, and those of the side from aboue downeward. Then beholde the Coast how it goeth by the squares of the first Paper, and likewise the tracting or drawing in the squares of the second, in the selfe same order and proportion, as it is there, and so shall it remaine reduced to the point which you desire, & this shall serue for a patterne to set in the ruled Carde.

Here

Here followeth the manner of the translating of the Carde from one forme into another, greater or lesse.





Here followeth a similitude of the Mariners Carde.

The Pilots and Mariners neither vse nor haue the knowledge to vse other Cardes, then onely these that are plain, as I haue said. The which, because they are not Globus, spherical or round, are imperfect, and false to shew the true distances. For in how much they depart from the Equinoctiall, toward which soeuer of the Poles, the Meridian lines are contract narrower and narrower: In such manner, that if two Cities or pointes in the Equinoctiall, should bee distant of Longitude 60. leagues, and in the selfe same Meridian at 60. degrées from the Equinoctiall, toward eyther of the Poles, should be other two Cities or points, they should bee distant in Longitude but onely thirty Leagues. And for the better declaration and vnderstanding hereof, I say, that if two shippes should depart from the Equinoctiall the one distant from the other a hundred leagues by east and west, and that eyther of them should sayle directly by his meridian toward the North, then when eyther of them hath the Pole ouer his Horizon, 60. degrées, the one shall bee distant from the other onely 50. leagues, by the Paralell of East and West, as appeareth by the plaine Cardes, that they haue the selfe same hundred leagues. And beside these considerations, one errour bringeth in another, and so another an other. Whereof to speake any more here, it shall be to certain Pilots (as the Prouerbe saith) not onely to giue musicke to the deafe, or to paint a house for blind men, but shall also be an endlesse confusion. Furthermore it is necessary to consider, that good Cards ought to haue the Coasts, Ports, Cities, & other places, situate according to the winds or lines thereof, proportionally as they are in the worlde, and not by the winds that the compasse sheweth. This I say for the North-easting or North-westing of the Compas (called the variation) as hereafter I will touch in the fifth Chapter. And likewise shall you diligently obserue, that the graduation of the Carde shew the same in their proper altitudes. The cardes that lacke this ought to be corrected

and

amended by wise and expert men: saving that in the Leuant Sea (called Mare mediterraneum) and in the Channell of Flanders (called the narrow Seas, it is not conuenient for the Nauigation, that the Portes be marked in the Cards by the winds, which the Compasse sheweth, for asmuch as they sayle not by the Altitudes of the Pole. Likewise it shal not be inconuenient, but rather very necessary (to auoide so many errors, of the which doe flow great daungers, and such a confusion, that it were néedefull for certaine learned Cosmographers, and expert in the Art of sayling, to verifie the altitudes of the pole, that are of Ports, Capes, Ilands, and people by the coasts of the Sea, and in like manner, truely to describe the coasts of the land, especially of the nauigation of the West Indies, or Mundo Nouo, where it hath pleased God that so many Nations and people haue receiued the Water of holy Baptisme, comming to the knowledge of the true God, whereby the Christian Empire is greatly amplified, beside the great riches had by the said Indies. And a further hope of many great benefites to be expected to the generall good of this whole kingdom, through the Plantation already happily begunne in Virginia, no doubt likely to proue as great a glory to our nation, as the planting of the West Indies is to the Spaniards, and the trade thereof in time to bee most beneficiall, both to our Marchants, and Mariners, to the great and vndoubted aduancement of this most excellent Art of Nauigation, by the ayde whereof, such remote and vnknown Countries and people are discouered, and wee made pertakers of many rich commodities, which otherwise would obscurely lie hidde vnto vs.

CHAP. III.

Of the vertue and property of the Loadstone, called in Latine Magnes, and in Spanish, Piedramon.

The Load-stone (as writeth Cardinall Cusanus) hath substance, vertue and operation. His vertue is engendered of substance, Essence or beeing, and of his Essence and vertue proceedeth his operation and effect in such sort, that this stone communicating his vertue to yron, by reason thereof, causeth the yron to moue, although betweene the one and the other be a cuppe or plate of siluer, or a table or any other like thing.

The attractiue, or drawing force of the Lode-stone, causeth the nature of yron to be and rest in it, and that so firmely and quietly, that being naturally heauy and ponderous, it descendeth not, because his nature resteth not in himselfe, but is vnite with the nature of the stone, which seemeth to extend it selfe, and as it were to cast foorth a liuely spirit of inchanting vertue. Insomuch that (as we see by experience) by the said vnion, it not only distributeth his vertue to one yron, but that yron likewise to another, and that other again to another, and so forth, vntill of many rings or lincks of yron be made a chaine.

S. Augustine (as he writeth in his bookes, De Ciuitate Dei) did maruaile, that he saw an yron moue it selfe vpon a vessell, by mouing the Load-stone vnder the vessell.

It is called Magnes, because the Inuentor or finder thereof was so named: (who as Plinie writeth) keeping Cattell in East India, had his shooes soled with plates of yron, and yron nayles, such as they vse in Gascoine, and had in his hand a staffe with a pyke, or hooke of yron, and resting himselfe vpon a quantity of this stone, could not remoue his feet, neyther lift vp his staffe. Then staying a while astonished, as ignorant of the cause, at the length beganne to perceiue the property of the stone, and to vnderstand the attractiue

ver,

vertue thereof. The colour of it differeth not from iron and was therefore called quicke yron or liuing yron. The best kinde of these stones, is of Azurine or blew colour, as the sea sometimes appeareth.

Of these, are found fiue kindes or differences. The first is, of Ethiope. The second, of Macedonie. The third, of Lechio in Boœtia. The fourth of Troada, neare to Alexandria. And the fifth of Asia, but at this day, it is found in diuers other places. It is founde also in many places in Spaine, as in the hill Morena, neare vnto the village of Calera, beeing of the order of Saint Iames, in the prouince of Leon. Likewise in a hill of Moron, in the territory of the Earle of Vrenia, is a great quantity thereof, and in diuers other places. The stone that wee most commonly vse is of the Iland of Elua, of the Lord of Pomplina, which I iudge to bee better then that of Denmarke. This and the other, haue vertue to draw yron vnto them. And true it is that Teanxedes writeth, that in Ethiope is found another kinde of this stone, that putteth yron from it. Auerroes the Commentator of Aristotle, denyeth that Magnes draweth yron vnto it, but sayth, that yron by his naturall inclination, doth moue to the stone, as to his naturall place, by a certaine quality, which the stone impresseth in yron: and beside this vertue and property, that it hath to draw yron vnto it, it hath also another, and that is, that it giueth vnto yron vertue and power, to shew the two pointes of the Horizon, where it cutteth the Meridian, that is in the two windes of North and South. These vertues are found more intent, in onely two partes of the stone: and these are euer opposite or contrary the one to the other, and so are they contrary in operation. For yron touched with the one parte and placed where it may remoue freely, will shew the north: and an other yron touched with the other parte will shew the South. Finding this experience, may be knowne, what part of the stone aunswereth to the North, which the Mariners call the face of the stone, and likewise of the South.

This stone is so necessary, that without it, Nauigation should be imperfect and vncertaine, because it giueth life to the Needle and Compasse, which leadeth and guideth the Pilote, that hée may goe certainely in the day, and not erre or wander in the night. Also it sheweth and directeth to compasse the world, and to know the windes. And therefore forasmuch, as the Compasse is so necessarie, wée entend to shew the order and manner how it ought to be made for it may chance to fayle, or be lost in the voyage.

CHAP. IIII.

Of the making of the Mariners Compasse for Nauigation.

TAke such paste or paper, whereof Cardes are made, and make in it a Circle, of the quantity of a spanne, or little more or lesse. In the which you shall paint the 32. windes with their colours, in such order as we gaue in the first and second Chapter of the windes, and of the Carte, not forgetting to marke the North with a flower deluce, and the East with a Crosse, And more then this, may euery man garnish and beautifie the same, as séemeth best to his fantasie. Then on the lower or neather parte of this Paste, you must draw a line, which shall be directly vnder that of the north and South, which shall bée the marke for the setting of the Irons and Stéeles. Then shall you take wyre of yron or stéele, of the bignesse of a great pinne, or according to the bignesse or the roundnesse of the paste, floure, rose, or flie, as it may be called. This wyre must be bowed double, so that euery of the parts may be equally as long as the Diameter of the flie, and a quarter part more. The ends or points of these yrons or stéeles, must be pinched together, and made close, and open in the middest, the one from the other, vntill the ends come to bee equall with the extremities of the Diameter of the flie, and so shall the stéeles remaine in manner, in forme of an Egge. These wyres or yrons must

muſt bée made faſt in the neather parte of the Flie: ſo that their extremities, ends or points come preciſely by the line of North and South.

And to fix or faſten them ſo, they muſt be couered with a thinne paper glued, leauing the points and ends vncouered: and thoſe endes muſt be touched with the Load-ſtone, in this manner. The parte that is vnder the Flower Deluce, muſt bée rubbed on that parte of the ſtone that anſwereth to the North, as is ſayde in the Chapter before.

And this ſhall ſuffice for the perfection of the Compaſſe: Yet ſome there be, that for ſuperaboundance, doe touch the other part of the Iron, with that part of the Stone that anſwereth to the South, although it may ſuffice to touch it onely with the other part. This touching of the yron with the ſtone, that the demonſtratiue or working vertue may ſhew it ſelfe foorth, muſt bee done with giuing certain ſtrokes with a hammer, on that part of the ſtone, wherewith the yron muſt be touched, that is to ſay, in the North part or the South: and from thoſe will come forth of the ſtone certaine beardes, like ſmall Pickles; whereon you ſhall rubbe the point of the yron, as you would whet a knife, and ſo ſhall certaine of thoſe beardes of the ſtone, cleaue and ſticke faſt to the yron. And the yrons thus touched with the beardes cleauing to them, you muſt take a pricke or point of Latyn, of Pyramidall, ſharpe, or Stéeple forme, which is broad below, and ſharpe aboue toward the point, this is made round or eight ſquare, as ſéemeth beſt, and in the neather part or breadth, it muſt be boared (but not through) with a borer which muſt alſo be of Pyramidall forme, and enter into the middeſt of the ſaid Pyramidall pricke or point of latyn vnto the middeſt, or ſomewhat more. This Pyramidall point (which the Mariners call the Capitell) muſt bee of height halfe a finger breadth, or according as the Compaſſe ſhall bee, and muſt be put through the Center of the flie, ſo that the point come forth on the higher part thereof, and muſt there be made faſt, and well fixt.

Then

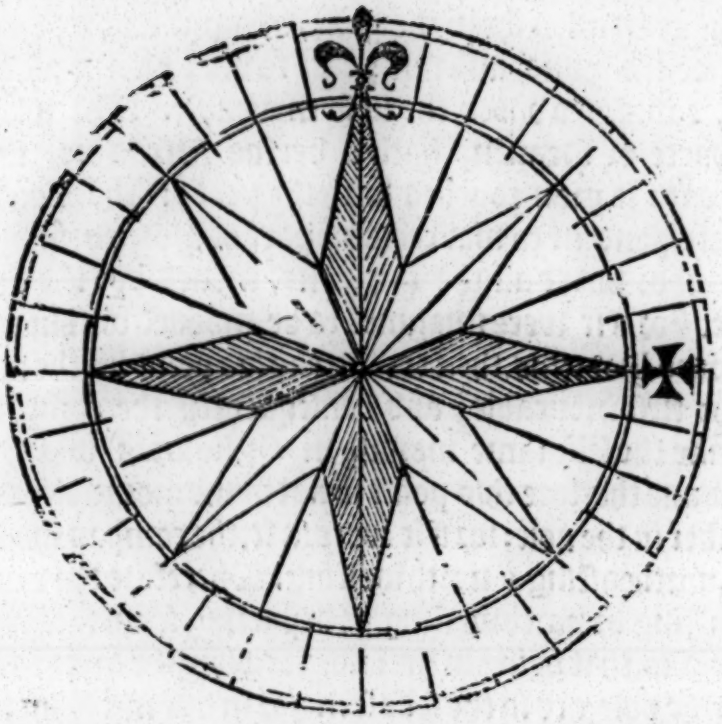
Then shall you take a round boxe of wood, within the which the néedle may be, not touching the sides of the same, and this must be of the height of the halfe Diameter of the Compasse. And the ground or bottome thereof must bée set to it, as the couering of a boxe, that it may be easily taken of, & put on, to haue often recourse, to touch the yrons with the stone (which they call séeding) when néede shall be, that the vertue of the Compasse fayle not. Also in the middest of the ground, or flore of the boxe, you must set a sharpe point or pricke, made of a wyre of latyn, this must stand right vpp, and vpon the pricke or point thereof, you must set the boxed hole of the Capitell, and that the winde enter not aboue, you shall couer the boxe with a glasse: And thus being touched with the North, and consequently all the other windes.

And here is to be noted, that after the irons or needle of the compasse hath béene touched in any of these manners, if you bring the North part of the stone, to the North of the Néedle or compasse, then will the North of the Néedle come to it, And if you bring the North part of the stone, to the South part of the Néedle, it will flée from it.

And contrariwise, if you bring the south part of the stone, to the south of the néedle, it wil come to it, and if to the North it will flée from it. This is vnderstoode, the néedle or compasse standing as it should be. And this also is a good signe, to know, which is the North part and South parte of the stone.

Moreouer this boxe must be put within another Boxe, in the which it must hang vpon two circles of latyn, annexed the one within the other, which serue that the Compasse sway not, or hang toward the one side or the other, although the Shippe sway. and this boxe also must haue his couer of wood, to kéepe the other. You shall likewise obserue that the point of the Capitell, and the hole thereof, and also the point or pricke vpon the which it resteth, be vpright, and likewise the Rose, that it decline not to one part or other, and if it bee quicker, then it ought to be, then make the point that it goeth vpon somewhat blunter.

The



CHAP. V.

Of the Effects or property that the Compasse hath to the Northeasting or Northwesting wherby is known the variation of the compasse.

MAny and diuers are the opinions that I haue heard, and also read in certaine Writers of latter dayes, as touching the north-casting and north-westing of the Compasse, and yet me seemeth that none doth touch the pricke, & few the white. They call it northeasting, when the needle sheweth or pointeth from the north, which is his true mark, toward the northeast, and north westing, when from the north

North, it declineth toward Northwest. For the better vnderstanding of these differences, whereby the Needles differ or vary from the Pole, you must (being in the Meridian where the compasses shew the Pole) imagine a point vnder the Pole of the world, and this point to bee without all the heauens, contained vnder the first moueable. The which point or parte of Heauen, hath a vertue Attractiue, that draweth vnto it yron touched with the part of the Loadestone, correspondent to that certaine part of Heauen, imagined without or vnder all the Heauens, moued by the first moueable. For if it were imagined to be mooued within any of the moued Heauens, then the attractiue point by the mouing of the first moueable, and consequently the compasse should make the selfe same mouing in 24. howres, which is neuer séen: and therfore this point is not in the moueable heauens, neither in the pole: for if it were in it, the compas should not vary, northeasting & northwesting. Therefore the cause of northeasting or northwesting, or departing from the Pole of the world, is, that being in the said meridian, the attractiue point and the pole, are in the selfe same, or in one meridian: & the compasse shewing the attractiue point, sheweth directly the pole: and departing from the same meridian toward the East (the world being round) the pole of the world remaineth to vs on the left hand, and the point of the attractiue vertue, shall be on the right hand, which is toward the northeast wind. And in how much more we shall sayle toward the east, the distance shall appeare greater vnto vs, vntill wee come vnto the 90. degrées, and there shalbe the most and greatest northeasting, & passing from thence further forward, it shall appeare vnto vs, that the attractiue point commeth neerer & neerer vnto the meridian line, and so much shall the compas go bettering or amending the northeasting, vntill it returne to the selfe same Meridian in the opposite, or contrary part from whence they came, or where they began, and then shall the attractiue point be directly to them vpon, or against the Pole of the world, and the compasse shall shew or point

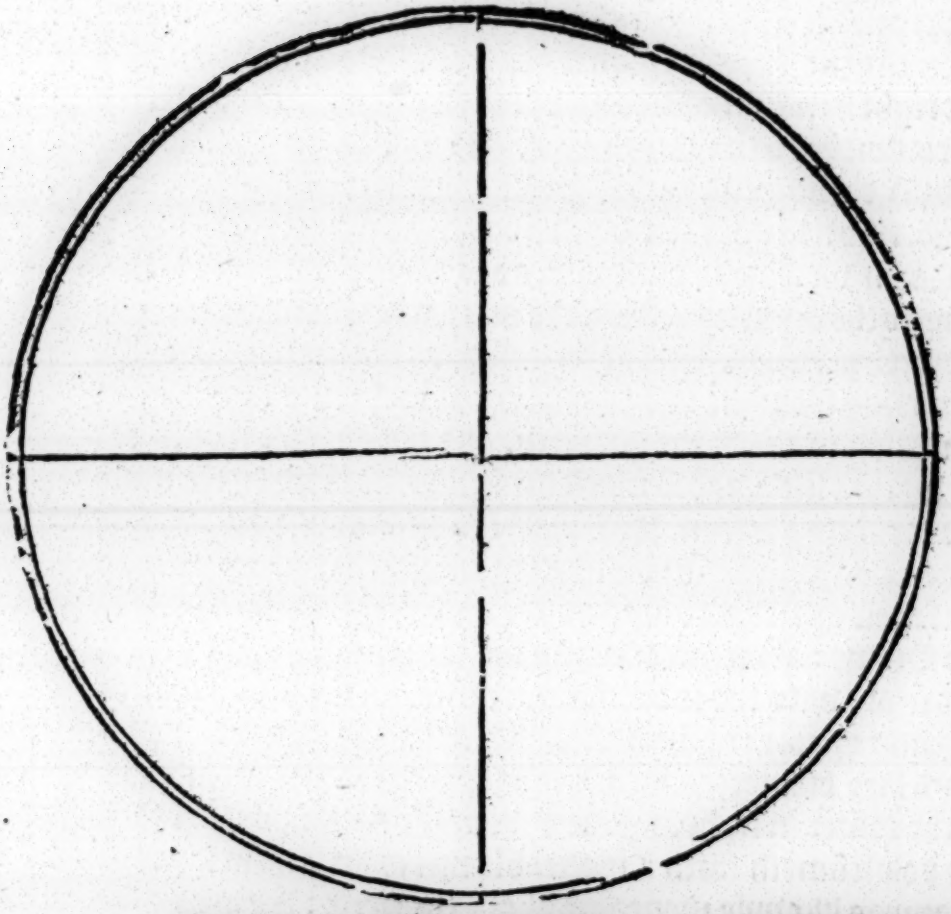
directly

directly toward it. And againe, passing further forward, the Pole of the world shall remaine to the right hand, and the point attractiue to the left hand, and so shall the compasse beginne Northwesting, increasing it vntill it come from thence to the 90. degrées, and there shall be the most of his Northwesting. For turning toward the Meridian from the Attractiue point, it shall go amending or bettering, vntill it returne to the selfe same Meridian, from whence it departed, and there shall the compasse shew the Pole of the world, directly by or ouer against the attractiue point, which is perpendicularly vnder the Pole. And if from thence they should turne, to passe toward the West, the pole should rest to the right hand, & the attractiue point to the left, and so shall the variation be to the Northwest, and this is the cause of the North-easting and North-westing or variation of the compasse. Also it is not to be vnderstood, that this North-easting & North-westing is vniforme, as is the departing (or according to the departure) from the meridian, where the compas sheweth perfectly, but rather before at the beginning of the departing from the said Meridian, it maketh difference, or variation in a certaine quantity, and the increase that is afterward is little, and so much the lesse, in how much the more the departing is from the said Meridian: for it is a passion of the circles, diuiding or cutting themselues in the Sphcare: so that these differences are, as are they of the declinations of the Sunne: which neare vnto the Equinoctials are great, and neare vnto the Solstitials are litle: all the which shall euidently appeare in the figure following, which is a circle diuided by 2 diameters, into 4. equal parts, cutting themselues in the center in right angles: & from the center point (called the pole) cõmeth forth a moueable meridian, and in it goeth a compas likewise moueable about the circle: the attractiue point is somewhat distant from the pole of the world, and from it commeth forth a thréd, which must euer passe by the North and South of the compasse. And the compasse béing in the Meridian of the point attractiue, that passeth by the

pole

pole shall shew the pole, and without that shall goe northeasting, or northwesting, so varying and departing from the true Meridian that commeth fourth of the Pole of the world. It is the opinion of some Mariners, that the Meridian where the compasse sheweth directly the Pole, passeth by the Iland of Sancta Maria, and other say, by the Iland of Caneruo in the Asores.

Demonstration of Northeasting.



And whereas the inconuenience is manifest and notorious, the same must be remedied with prudence and time, & not to be negligent in the voyage, but euer to vse and obserue experience, more profitable then the subtle and curious questions

questions of the secret searchers of naturall things without experience, whereof reason taketh his principall ground. And therefore the wise Pilot ought to know by experience (as many of them doe not) how much a good Compasse doth varie, Northeasting, or Northwesting from one Port to another. So that to know how much the compasse doth varie, Northeasting, or Northwesting, from one place to another (as to say, halfe a quarter, or more or lesse in quantity, as they are distant from the said Meridian, where the compasses shew the Pole) he shall in the Nauigation take hed, and well consider, in any such voyage, Northeasting or Northwesting, in the points of the Compasse. And this shall bee to sayle truely by the pointes or lines that the Carde doth certainely shew. As for example, In sayling from any Iland that is in the saide Meridian, or from any other part in seeking of any Port, that is to them true Northeast, if by this way the Compasse should Northeast halfe a quarter, then sayling by the points or lines of the Compasse, Northeast halfe a quarter to the North: their Nauigation shalbee (excepting other impediments) to the Northeast which the Carde sheweth: And by this point or line, must bee made the account of such a voyage. And so by the pointes of the Carde, they shall directly finde the Porte that they sought. And by this order, shall they gouerne themselues in all Nauigations. For the which, it is conuenient that wise and expert Pilots, should make notes of obseruations of Northeasting and Northwesting, that is from Port to Port, and to make compilations and gatherings of such notes to carry with them in their ships for regiments: and not to bee busie or curious to amend their Compasses, or with the stone to rubbe the irons or Steeles, neyther on the one side or the other, from whence the Flower Deluce doth shew: for this should cause many inconueniences. Neyther ought they to admit in their Cardes two graduations: especially, for that to know how much in euery place the Compasse doth goe aside, or vary from the true Meri-

dian

dian may easily bee made an Instrument to shew the same by the Sunne in the day, and by the starres in the night.

CHAP. VI.

Of the Introduction and Principles of the Art of Nauigation.

FOr asmuch as now we haue the guide, which is the compasse, it is conuenient to enter into the way, which is Nauigation. The which (as we haue said) is to goe or passe by water from one place to another. And this presupposed, I say, that he that desireth to attempt nauigations must know two things which the carde shall shew him. The one is, by what point or line he ought to sayle, and this shall the lines of the sayling carde shew him. The other is, the leagues of the distance, and this shall the scale or trunke of the leagues shew, taking with a compas the distance of two places, and applying it to the scale. The knowledge of these two things ought the Pilot to beare in memory, and to put them in effect, ought to direct his foreshippe to the selfe same winde, which the compasse doth shew. For the distance, hee ought to know how much the shippe goeth dayly, well considering and obseruing the winds, tides, currents, and all such things as may be with him or against him And according hereunto, hee shall know how much he hath gone, and what remaineth for him to goe, and whether he be farre off, or neare vnto the place whither he entendeth to sayle: the which in Nauigation is the end desired. And because this estimation or computation cannot bée iust and exact, especially in a long Voyage, or in long time: it shall bee conuenient that we rectifie or amend it, knowing the place where the ship is, on the superficiall part of the water, by the place that answereth to it in Heauen. This place of heauen, is knowne by the altitude of the pole, and by the altitude of the pole, is knowne the altitude of the Equinoctiall, and by the Altitude of the Equinoctiall and declination of the Sunne, is known

the

the Meridian altitude, and contrariwise, knowing the Meridian altitude and declination of the Sunne, is knowne the Altitude of the Equinoctiall, and by the Equinoctiall, the Pole, and by the altitude of the Pole is knowne the Altitude: and this is the place that is desired to be known. But for asmuch as the heauen is moueable from the East to the West: this place is not known as a certain point, but is knowne as a line or paralell at a certaine distance from the Equinoctiall, and it is known in what point of this paralell the Shippe is, by the Altitudes that are taken from heauen, but it is knowne by the line that the ship hath gone, as wee will further declare in the 13. Chapter, of making a point or pricke in the Carte, and in this maner you shall haue reckoned the way that the shippe hath gone, and consequently, the way that it hath yet to goe.

And forasmuch as these Altitudes are so profitable and necessary, it shall be needfull to giue rules how wee may vse them to our most commodity: and for this is presupposed to know, that all places situate on the superficiall part of the earth, and water, eyther they are vnder the Meridian, so that they haue, or where they haue one selfe same longitude, and differ in latitude, or are in one paralell, where they haue one self same latitude, and differ in longitude, or are in diuers Meridians and paralels, where they differ in longitude and latitude. And I say, that if they haue one selfe same longitude, they sayle from the one to the other, by the line of North, and South, and how many degrees doth vary the Altitude of the pole, and of the Equinoctiall in heauen, so many degrees haue they gone by sea or by land. If two places haue one selfe same latitude, they passe from the one to the other by the line of East and west. And in such manner of voyage, the Altitudes doe not profite vs, because there is no variation. If they differ or varie in longitude and latitude, they sayle from the one to the other, by some of the other lines. But there are more degrees that correspond the way that the shippe maketh then the degrees that vary the Altitudes of the Equinoctiall

all and the pole. And this difference shall be greater, in how much the line shall draw neare to the East and West and how much it shall draw neare to North and South, it shall bee lesse. Of the degrees or leagues, that answere to euery degree of the variation of the altitude, we will entreate hereafter in the 12. Chapter.

These Altitudes are knowne many wayes, but especially by two, as by the Meridian Altitude and declination of the Sunne (as we haue said) is knowne the altitude of the Equinoctiall, & by it the altitude of the pole. The second way, they are knowne by the altitude of some fixt Starre, of those that are not hidde. And among many other, the North starre is taken, because it is nearest to the pole. To know the Altitudes by the Sunne, three things are necessary, that is to say, an Instrument, the declination of the Sunne and rules. The Instrument to know the Meridian Altitude shall be the Astrolabie, because it is most commodious for this purpose, whereof we will entreate in the Chapter following. The Declination of the Sunne (which is to take it away, or to ioyne it with the Meridian Altitude,) wee haue already described in the third Chapter of the second parte: The rule to know when the declinations must bee ioyned with the Meridian altitude, or taken from it, we will giue in the 8. Chapter. To know the Altitudes of the Pole, by the altitudes of the North starre, two things are necessarie, that is, an Instrument and rules. The Instrument wherewith the Mariners are accustomed to take the Altitudes of the North, they call Belestilia, which is a Crosse staffe, whereof we will write hereafter in the 9. chapter. And the rules of the turne or compasse, which the north starre maketh about the Pole, we will declare in the 10 chapter,

CHAP. VII.

Of the making & vse of the Astrolaby, with the which the Mariners take the altitude of the Sunne.

TAke a plate of Copper or latyn (which for this purpose is better then any other mettall) of the bignesse that you

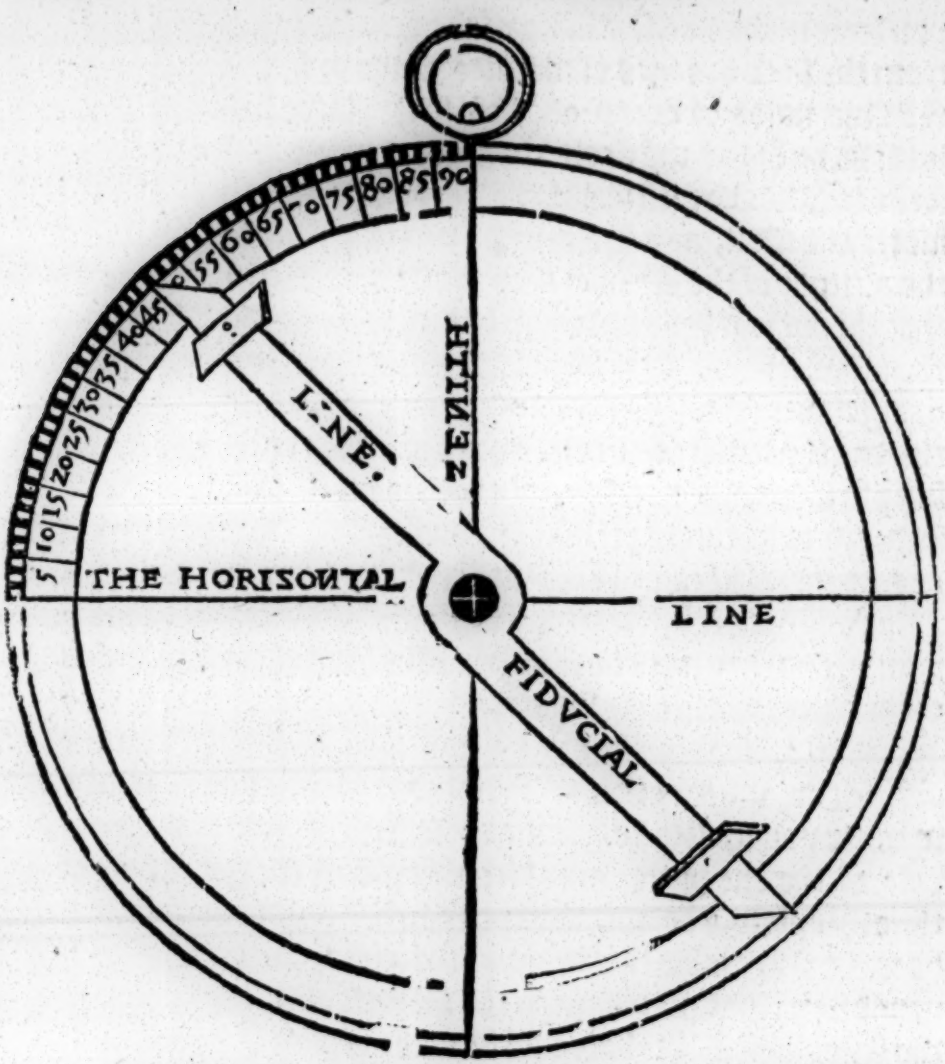
you desire to make the Astrolabie, and is commonly of the biggenesse of a Spanne of the Diameter, and let it bee of the thicknesse of halfe a finger at the least, for the weightier that it shall be, so much shall it bee more steady to make the Altitude, This plate must be made round by a Circle, leauing a comming forth of the Circle or corner in the which you shall put a Ring or handle with a hole, whereby you may hang the Astrolaby, by a threed or line to take the Altitude.

After it is thus made, with the ring or handle annexed thereto, make it bright and smooth, polished on both the sides, and all of one equall thicknesse, that one side bee not heauier then another, which you shall trie in this manner, hang the plate by the ring or hole that you haue made, and from the same hole hang a plomet of lead, fastned to a hayre, or fine thread of silke. The Astrolabie thus hanging free, and at libertie with the plomet, if then the threede fall vpon the Center of the Astrolabie, it is well, but if the threed doe leane or swerue to the one side, or to the other, from the Center, then is that side thicker and heauier then the other, and must therefore be made thinner vntill the threed fall iustly vpon the Center. This done make a Circle vpon the said Center, a little within the circumference of the Astrolabie. Then draw a Diameter from the center of the hole, in the which the ring or handle is, vnto the Center of the Astrolabie, traversing or ouerthwarting the whole Circle. And this shall be called the line of the Zenith, or verticall point, which also shall bee cut with an other Diameter vpon the Center, making right angles with it, & this Diameter shall be called the Horizontall line. These two Diameters shall diuide the circle into foure equal parts. After this you shal make an other circle, so much more within the second, that betweene the circumference of both the circles, may be contained the numbers of the Degrees. Then (the Astrolabie hanging before you) you shall diuide the one parte (being the superiour and left parte)

first into three equall parts, and euery part shall contain 30 degrées. Then shall you diuide euery part of these into three other equall parts, and they shall containe 10. degrees: and euery of these diuide into two parts, and they shall containe 5. degrees. This done, put a ruler vpon the center of the Astrolabie, applying it to euery of the pointes that diuide the saide parts, and draw certaine lines that passe from the circumference of the first circle, vnto the lesse circumference, & in the space of the lesse circle write the numbers of the degrées, beginning in the Horizontal line, and in that space put 5. and in the second ten, and so forth of the other, vntill the 90 degrées end in the line of the Zenith, then shal you diuide the spaces that are betwéene the first Circle and the second, euery space into fiue, which shall make the 90. degrées. The astrolabie thus made, you shal make the Alhidada or Label: for the which you shall take a plate of latyn, of the breadth of scarsely two fingers, and as thicke as the Astrolabie, also as long as the Diameter of the Astrolabie, and make a line in the middest thereof by the longitude, in the middest of this line, make a circle, so great that it may touch in the sides of the plate, then cut of this plate on the one side, that which it hath from the line to the right hand, and on the other side, that that it hath from the line to the left hand, leauing the circle whole. This line that shall passe by the Center of the Circle, is called Linea Fiduciæ (that is) the line of confidence. which is that, that sheweth in the degrées the altitude that is taken. Then shall you take away the ends or corners of the Alhidada, that are without the Line, so that you touch not the line. This done, you shall make two little rising or raysed tables or plates of the same mettall, where of the Astrolabie is made, and of the selfe same thicknes that is the Alhidada or little lesse, & of the breadth of the Diameter of the circle of the Alhidada, and let them be a thumbe in height or breadth. In the middest of these two places by the height you shall make a line. When these are made equal, & al their angles right, in euery line of these that

you

you haue made, you shall also make two holes, equally distãt from the sides or edges of the saide plates or tablets. And of the two holes of euery of these little plates, the one hole must be as big as may contain a great pinne, and these shall serue to take the altitude of the stars. The other must bee so subtle and smal, as a fine sowing néedle, & these serue to take the altitude of the Sunne: they must be made in such maner, that the outward part of them be bigger, and lesse within, of the quantity that I haue said. These tablets or erected plates being thus made, they must be sothered in the Alhidada, betweene the center and extremities or ends of the same, making in it certaine notches, where they may be made fast and sothered, or leauing first in the plates certaine sharpe pointes or corners, that may enter into certaine holes, made in the Alhidada. whereby they may be made fast vnderneath with pinnes, and they must be so set, that the line where the holes of the plates are, may fall vpon the line of confidence of the Alhidada, so that the one halfe of the plate be set vpon the Alhidada, and the other halfe without it, or at large. In like manner you shall take good aduertisement, that the great hole of the one plate, stand directly against the great hole of the other plate, & be nothing at al awry, this done, you shall bore the Astrolabie through by the center, making a very round hole, that may haue in the middest of it, the center of the Astrolabie. This hole shal be of the bignes of a gose quil: and the like shall you make in the center of the circle of the Alhidada: then shall yon make a pinne or nayle, of the same latyn, the which on the vpper part of the Alhidada may haue a plaine and round head: this pinne also shall bee very round and smoth, that it may enter iust and close into the hole of the Alhidada, and Astrolabie, and at the end or point thereof, comming forth on the other side of the Astrolabie, must be a hole made sideway through the pinne, close to the plate of the Astrolabie, of the bignes of a little nayle or pinne, that may be put therein, to make fast together the Alhidada with the Astrolabie, so that the Alhidada may therby be turned round about the Astrolaby, as appeareth in this figure following.



To take the altitude of the Sunne, hang vp the Astrolabe by the ring, and set the Alhidada against the Sun, and rayse it, or put it downe in the quarter that is graduate, vntill the Beames of the Sun enter in by the little hole of the other tablet or raysed plate, and precisely by the other little hole of the other tablet. Then looke vpon the line of confidence, and how many degrees it sheweth in the quarter that is graduate (beginning from the Horizontall line) so many degrees of height hath the Sunne. In like manner shall you doe to take the altitude of any other Star, looking through the great holes, because this may hardly be seene by the little holes.

CHAP.

CHAP. VIII.

Of the Definition of the Altitude, and how the Altitude of the Pole may well be knowne by the Meridian Altitude, and eleuation of the Sunne.

IT is conuenient to define the altitude, before we giue rules of the vse thereof. The altitude of the Sun, or the moone, or of any other Starres, is the distance, that is betweene it and the Horizon. And this ought to be accounted by the degrees of the great Circle which passeth by the Zenith, and by the center of the Sunne, or of the Moone, or of the Starre, vnto the Horizon. And the degrees that are from the Horizon to the Starre, or to the Sun, that is the Altitude, and the degrees that are from the Center of the Starre, or of the Sunne, vnto the Zenith, is called the complement or supplement of the Altitude. The Altitude of the Equinoctiall is euer counted by the Meridian. And the degrees of the Meridian, that are betweene the Equinoctiall and the Horizon, is the Altitude of the Equinoctiall, and other so many are they that are from the Zenith to the Pole. For the Altitude of the Equinoctiall is equall to the complement of the Altitude of the Pole. The degrees of the Meridian that are betweene the Equinoctiall and the Zenith, is called the complement of the Altitude of the Equinoctiall, and is equall to the Altitude of the Pole. And although we haue defined the Altitude in generall, yet shall wee onely profite our selues by the Meridionall altitude of the Sunne. The Meridian Altitude is the greatest Altitude that the Sunne hath euerie day, and this shall be, when the Center of the Sunne is in the Meridian. And the Arke of the Meridian that is betweene the Horizon and the Sunne, is the Meridian Altitude: So that when we say the altitude of the Sunne is taken, it is vnderstood at midday. The Shadowes that the Sun then maketh, are in three sorts: for eyther to vs it casteth the shadow toward the North part, or toward the South, or perpendicu-

dicular by a right vp line, so that at midday or noon, nothing that standeth vpright, giueth any shadow at all. But forasmuch as there is such variation in declinations, altitudes, shadowes, and Paralels, it shall bee necessarie to giue rules for all variations. And these shall be reduced into foure briefe and compendious rules, the which I haue here described, that the witty may haue profite by them, and the rude learne them, not caring for the rules of the Mariners, because they are so long and tedious, for (as the Philosopher sayth) it is vainely done by many, that may well be done by few.

When the shadow shall be perpendicular, it is because the Sunne is in the Zenith, and 90. degrées aboue the Horizon. And then how many degrées of declination the Sunne hath, so much shall we be distant from the Equinoctiall, toward the part where the Sunne declineth. And if it haue no declination, it and we shall bee vnder the Equinoctiall.

But when the Sunne and the shadowes shall bee to vs from the Equinoctiall toward one of the Poles, we shal take away the declination from the Meridian altitude, and then shall remaine the complement of the eleuation, which complement being taken from 90. degrées, then shall remaine that which we be distant from the Equinoctiall toward the same Pole.

When the Sun declineth from the Equinoctiall, toward the one Pole, and the shadowes shall bee toward the other, wee shall ioyne the declination with the Meridian altitude, and if all come not to 90. then subtract them from 90. degrees, and wee shall haue the complement, and so much shall wee bee distant from the Equinoctiall, toward that Pole, to the which the shadow falleth: and if they bee more in number then 90. then the ouerplus of 90 shall we be distant from the Equinoctiall toward the Pole, where the Sunne declineth, & if they be iust 90, we shall bee vnder the Equinoctiall.

When the Sunne hath no declination, we shall be distant from the Equinoctiall, the complement of the Meridian altitude toward the Pole where the shadowes are. By these

rules

rules, beside (the vse wherof wee haue spoken) may bee knowne how much is the greatest declination of the sunne, the Altitude of the Equinoctiall, the day, houre, and minute, when the Equinox was, the which is knowen as followeth.

Hauing taken the greater Meridian altitude of the summer (which is in the beginning of Cancer,) and the lesse of Winter (which is in the beginning of Capricorne) taking away the lesse from the more, the rest is that, that is from Tropike to Tropike, and consequently parted by the middest, is the greatest declination.

As for example, being in the Citie of London, I find the greatest Meridian altitude of the ☉ in the beginning of ♋. to be 62. degrees and the lesser Meridian altitude, which is when the ☉ is in the beginning of ♑ to be 15. degrees, then taking 15. from 62. rests 47. and so much is from Tropike to Tropicke and the ½. which is 23. degrees, 30 minutes is the greatest declination.

Againe the greatest declination added to the lesse Meridian altitude, or subtracting it from the greater Meridian altitude, the rest is the altitude of the Equinoctiall aboue the Horizon.

As for example, the greatest declination 23 ½ added to 15 the lesser meridian altitude makes 38. ½. or taking from 62 the greatest meridian altitude, rests 38 ½. the height of the Equinoctiall in the City of London, or in any place where the Pole is elevated 51. degrees, 20. minutes, hereof it followeth that when we take the meridian altitude at 38 ½. that day is the true Equinoctiall which will bee the 11 of March, and the 13 of September this present yeare 1609.

So likewise when you take the height of the Sunne vpon the meridian, at 62. degrees of altitude, then is the sun in the true summer tropicke, or at 15. degrees of meridian altitude, then is the true winter tropicke, the summer tropicke being at the Sunnes entrance into ♋, and the winter tropicke, at the sunnes entrance into ♑, which is the 12. of June, and the 12. of December, this present yeare 1609.

Here it is not vnnecessary to be noted, that for the working and obseruing of these, and such like propositions, there is to be considered, that from the Equinoctiall to eyther of the Poles, is iust 90. degrées, and the height of the Pole, is the eleuation thereof, and hauing taken the height or altitude thereof, the same substracted from 90. that which remaineth is the eleuation or height of the Equinoctiall aboue the Horizon: for it is certaine that if the Pole be taken at 90 degrees aboue the Horizon, that is to say, if the Pole bee in the Zenith, then is the Equinoctiall in the Horizon, and loke how much the Pole is depressed from the Zenith, or verticall point ouer your head, so much is the Equinoctiall raysed aboue the Horizon towards your Zenith, and by this reason you may know the Meridian Altitude of the same, by adding the Declination, with the eleuation of the Equinoctiall.

CHAP. IX.

Sheweth the making and vse of the Mariners Crosse-staffe now commonly vsed.

HEre in this Chapter had Martin Curtis set downe the Discription and making of a Crosse-staffe, hauing onely one Transame, as hauing in his time not the knowledge of any other, but the same being worne out of vse and diuerse farre better now knowne: I haue thought good here to explane the making and vse of the latter, namely of that with thrée Transames now most commonly vsed: for the making whereof, it is necessary to haue a Table-board, &c. of such conuenient length and breadth, that vpon the superficies thereof a quadrant may bée drawne, whose Semidiameter may containe the iust length or somewhat more, that you would haue your staffe to bée of: for the better effecting whereof, it is good to couer the said table or board with paper, and vpon the said paper as I said, with a large paire of Compasses describe a quadrant in such maner, as is shewed

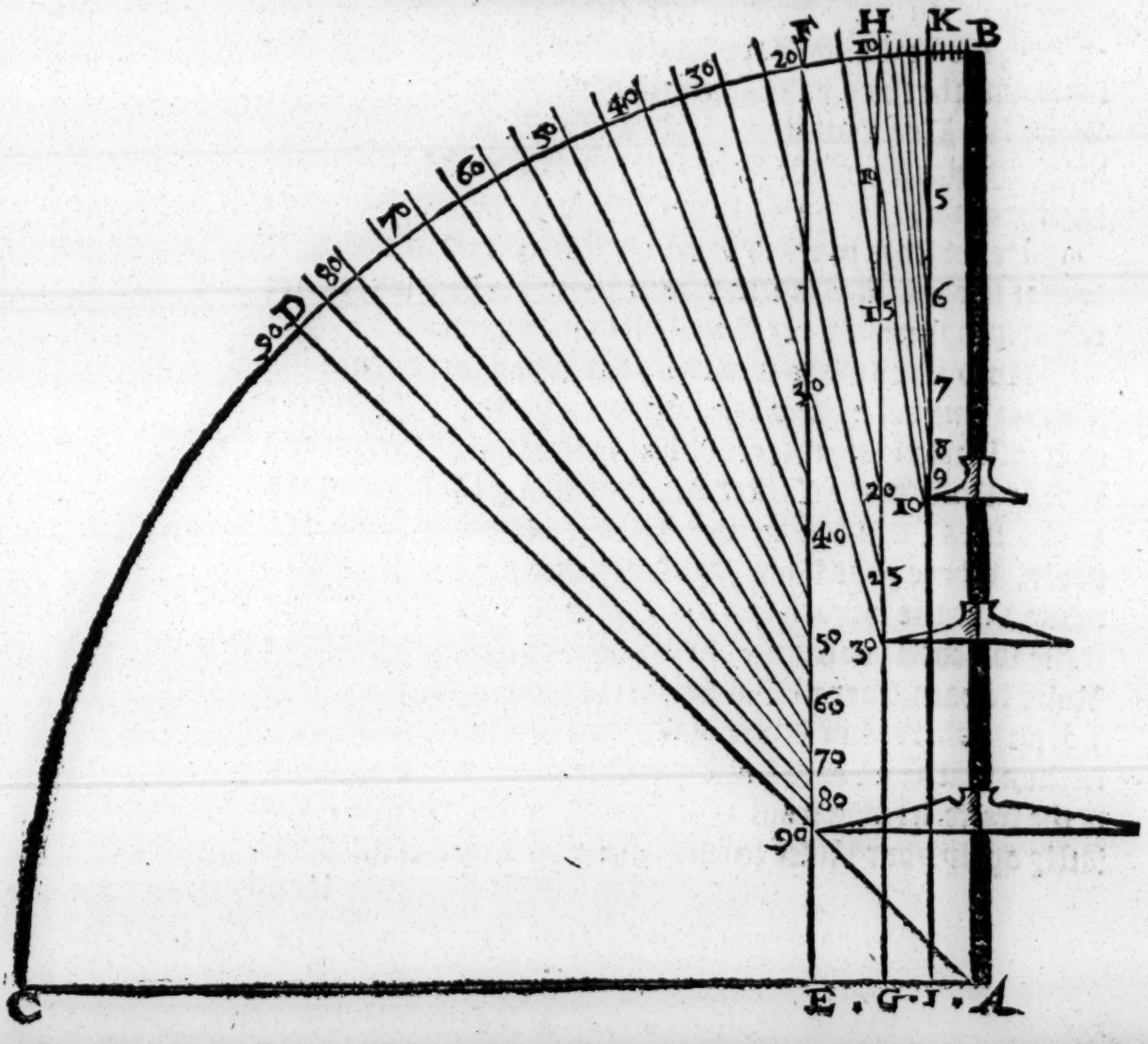
ed in the figure following, marked with the letters, A.B.C. that quadrant diuide into two equall parts, from the center to the Limbe, with a Diagonal Line, protracted by the line A. B. the halfe thereof, viz. that next vnto the perpendicular or subtendent, A. B let be deuided into 90. equall partes, from B. to D. and to the said Line A.B. draw three Paralell lines, from the Limbe of the quadrant to the base thereof, viz. the first distant from the said perpendicular 5. partes, marked with I.B. the second 10. marked with G.H. and the third 20. marked with E.F. which three paralell Lines, serues for the graduation of three sides of your Crosse staffe: the first serving from 5. to 10. the second from 10. to 30, & the third from 30. to 90. degrées of altitude, eyther of sunne or starres, where you are to note that the first Paralell line expresseth halfe the length of the shortest Transame or Crosse, the second, halfe the length of the middlemost Transame, and the third, halfe the length of the longest Transame, which said Transames or Crosses must be applyed each to his particular side of the staffe (viz.) the shortest to that side, which is marked from 5. to 10. degrées, the middlemost to that side which is marked from 10. to 30. and the longest to that side which is marked from 30. to 90. degrées, euerie one at such times as occasion shall be ministred.

Now it resteth to shew how to diuide each side into his peculiar number of degrees, answerable to the Transame or Crosse belonging thereto, which is thus done: lay one end of your Ruler to the Center A. and applying the other end to each seuerall diuision in the Limbe, betwixt 5. and 10. parts, where your Ruler shall each time cut the Line I. K. make a marke for each seuerall degrée, for that side of your staffe which serues from 5. to 10. degrées again, apply your Ruler to each seuerall Diuision in the Limbe, from 10. to 30. and where your Ruler shall each time cut the line G.H. make a marke for each seuerall degree: for the second side of the staffe, serving from 10. degrees, to 30. degrees, and lastly apply your Ruler to each seuerall deuision of the limb:

from

from 30 to 90. and where it shall each time cut in the line E. F, make a marke for the seuerall degrees, for the third side of the staffe seruing from 30. to 90. degrees, vnto which the longest transame is to be applyed. these three lines being thus marked, if you apply the three sides of your staffe each to his peculiar line, and deuide the said sides of it thereby you shall haue your staffe accommodated, whereunto you may apply the Crosses each seuerally as you shall haue occasion to vse them, noting that the shortest Crosse is to be vsed, when the sunne or starre is not aboue 10. degrees high, the middlemost when the sunne or starre is not aboue 30 degrees high and the longest Crosse, when the sunne or starre is betwixt 30. and 90 degrees high.

The demonstration of the said Staffe.



The said staffe being thus furnished with seuerall degrées, if the Artisan list to take the paines, hee may diuide each degree into 4.5.6.10.12.or 15.parts, each part containing 15.12.10.6.5.or 4.minutes, as hee shall thinke conuenient to bee comprehended within the length of the staffe, which being so accomplished, it resteth now to shew the vse thereof, which is so commonly knowne vnto euerie Ordinarie Sea-man, that few wordes will suffice for the explanation thereof: being thus, hauing fitted that Crosse to the staffe which in your iudgement will best serue for your altitude desired, set that end of the staffe where the degrées do end to the corner of your eye, right with the Center thereof, holding the Crosse right vp and downe, and winking with your other eye, moue the Transame or Crosse to and fro, till by the extreame ends thereof you may at once (with that eye at which the staffe is,) sée both the middle or center of the Sunne or starre and the Horizon, viz. the sunne or starre by the vpper end of the Crosse, and the Horizon by the lower end thereof, which being seene as is said, there stay the Crosse, and the number of degrées that is cut there with, vpon the side of the staffe belonging thereto, is the Altitude of the Sunne, starre, &c. desired: manifold are the other sortes of Instruments, by which obseruation may bee made eyther on shore or at the sea, but this being most common in vse, I haue onely set downe the description and vse thereof, Though I cannot but chiefly commend M. Wrights sea-quadrant, as also another quadrant now much in vse, whereby the sunne is to be obserued without looking thereat, with onely turning the quadrant towardes the sunne, and looking vpon the Horizon, the quadrant lying ouer your shoulder with your backe towards the sunne, for the vse of M. Wrights quadrant, he hath written thereof very amply in his correction of errors in Nauigation, and for the other it is so easie that it néedes no explanation: the vse of the Suns altitude thus, taken by obseruation is explained at large in the third chapter of the second part.

CHAP.

CHAP. X.

Of the Altitude of the Pole, knowne by the Altitude of the North ſtarre.

TO know the paralell in the which the ſhippe is, ouer and beſide the rules, there before of the Altitudes of the Sun, it is likewiſe known by the altitudes of the North ſtar. Theſe two manners are vſed, for that more credite is giuen to two witneſſes then to one: ſo that if by one ariſe any doubt, the ſame may be certified by the other, and alſo becauſe time may ſometime ſerue for the one, and not for the other, as to haue a cloudy midday or noone, and a cleare night.

The altitude is taken of the North ſtar, which is a ſtar in the extremity or end of the tayle of the leſſe Beare, being a conſtellation, commonly called the Horne. For this north ſtarre (of the moſt notable ſtarres about the pole) is neareſt vnto it, and ſhall therefore ſhew a leſſe Circle then any of the other, and ſo ſhall his Altitude differ little from the Altitude of the Pole. This ſtarre hath declination 87. degrees, and 8. minutes, and the complement to ninetie (which are two degrées and fifty two minutes,) is his diſtance from the Pole. And although that many holde opinion, that it is diſtant more then three degrees, yet it is now proued by the dayly experience of many expert both Aſtronomers and Mariners, who by diligent obſeruations haue found the true places of the ſtarres, then heretofore, and among the reſt, it is moſt certaine, that the ſaid Northſtarre is but two degrees, and fifty two minutes from the Pole, with their Longitudes, Latitudes, Declinations, and right aſcentions more perfectly, & preciſely then do the Mariners: for they account not onely by degrées, but alſo by minutes and ſeconds. Therefore whoſoeuer will preciſely know it, let him take the high eſt altitude of the North ſtarre which is his being ouer the Pole, and the leſſe altitude,

which

which is his being vnder it: then take away the lesse from the more, and the halfe of that that remaineth, shall be the distance of that starre from the Pole of the world.

And likewise by this experience may bee knowne the altitude of the Pole, and what all the other starres, that goe not downe vnder the Horizon, be distant from it. Joyning the greater altitude with the lesse, and that shall amount thereof, diuided by the halfe, shall bee the altitude of the Pole, and taking away this altitude of the Pole from the greater altitude of the starre, or the lesse from the altitude of the pole, the rest that remaineth shall be the distance of the starre from the pole, and as the pole is inuisible, it cannot bee seene or knowne, when the North star is higher or lower, except it be by the meane of some other marke: and for this is considered the position of the former Guards or watch, being one of the two starres called the Guarde, which are in the mouth of the Horne: which how much the said starre is vnder or aboue the pole, is knowne by often experience, and exact triall of the said former Guard, being vpon any point of the Compas, according to which distance of the North starre from the pole I haue here inserted, the height or depression thereof for any of the eight thiefe or Cardinall pointes: but for those that desire more precisely for all the whole thirty two pointes, let them resort to the Booke called the Sea-mans Calender, where their expectation may bee fully satisfied.

Common Rules.

The former Guarde beeing in the East, the North Starre is in one Degree and 37. Minutes vnder the pole.

The Guard being in the North-east, the North starre is two degrees, and fifty minutes vnder the pole.

The Guard being in the North, the Starre is two degrees, and 24. minutes vnder the pole.

The

The Guard in the North-west, the Starre 3'4. vnder the Pole.

The Guard in the West, the Starre is one degrée and 3'6. aboue the Pole.

The Guard in the Southwest, the Starre is two degrées and 50. minutes aboue the Pole.

The Guard in the South, the star is two degrées 2'4. aboue the Pole.

The Guard in the Southeast, the said North starre is 34. minutes aboue the Pole.

Note that these eight winds are made according to foure lines: whereof two are right, which are north and south, and east and west, and the other two are crooked, which are Northeast, Southwest, and Southeast, North-west. When the Guard and the Northstarre shall bee in the right line, it shall appeare cleare how they are, and when they shall bee in the crooked lines, it may bee séene, because the Guardes are the one by the other in a right line.

Here according to the prescription of Martin Curtis should haue followed an Instrument speculatiuely shewing the vnconformity of motion, which the North starre, with the Guardes make about the North Pole of the world, which being that, it is false and erronious, and much different from the truth, as experience hath now truely taught vs, by the painefull endeauours of many both learned and well exercised in these moderne times. I haue thought rather better to omit it altogether then by the sight thereof with his allegations (which doubtlesse in this time could not well be disproued) to incite any through ignorance of the truth, to rest doubtfull of eyther, and in steade thereof to supply the vacancy, with those things which are not onely necessary, but rather most needful for euery Sea-mans vse: as for the the declination or distance of the said North starre from the Pole, it hath béen recited at large in the former Chapter, and for the allowance that is to bee giuen thereto, eyther by adding or subtracting according to the bright aboue the Pole or depressi-

on

on beneath the Pole, it is set downe at large in my booke called the Sea-mans Callender for euery seuerall point of the compasse, in which respect to set the like downe here againe would bee superfluous, onely because that the rest of the fixed starres, are there set downe with their declination and right assention onely, without shewing the time of their comming to the Meridian, saue onely by their right assention, and the Table of the sunnes right assention therets adioyning, which is somewhat too intricate for many of the meaner capacities, to vnderstand, for whose ease I haue thought good here to insert a more particular Table of most of the principall of the saide starres, being of the first and second magnitude.

CHAP. XI.

Sheweth the declination with the points of rising and setting of certaine of the most notable fixed starres, with a perfect Table for the time of their comming to the meridian, from fiue to fiue dayes, in euery moneth through the yeare.

The first starre in the Rams horne is a starre of the third bignes, whose declination is 17 degrees, 17 minutes, northerly rising in the latitude of 52. degrees, or thereabouts, at North East and by East, and sets at North west and by west.

2 Oculus Tauri, or the Buls eye, is a starre of the first bignesse, hauing declination, 15 degrees, 38. minutes Northerly, and riseth in the foresaid latitude, at E. N. E. Easterly, and sets N. W. & by W. southerly.

3 Orions left foot, is a starre of the first bignes, hauing declination 5 degrees, 56. minutes northerly, rising E. S. E. Easterly, and setting W. and by South southerly.

4 Orions right shoulder is a starre of the first bignesse, whose declination is 6. degrees, 17. minutes northerly rising E. and by N. and setteth W. and by N.

5 The firſt in Orions girdle is a ſtarre of the ſecond bignes, whoſe declination is 38. minutes ſoutherly, and riſeth Eaſt ſetting weſt.

6 The great Dogge is a ſtarre of the firſt bignes, hauing ſouth declination 16. degrees, 12. minutes, riſing aboue our Horizon, S. E. and by E. Eaſterly, and ſetting, W. S. W. Southerly.

7 The little Dogge is alſo a ſtarre of the firſt bigneſſe, hauing 6. degrees, 13. minutes of North Declination, riſing E. and by N. and ſetting W. and by N.

8 The brightest in Hydra is a ſtarre of the ſecond bigneſſe, whoſe declination is 6. degrees, 53. minutes, ſoutherly, riſing E. and by S. Eaſterly, and ſetting weſt ſoutherly.

9 Lions Hart of the firſt bignes declination, 13. degrées 55. North, riſing E. N. E. and ſetting W. N. W.

10 The Lions tayle is a ſtar of the firſt bignes, whoſe declination is 16. degrées 58. minutes northerly, and riſeth aboue our Horizon N. E. and by Eaſt, and ſetteth N. W. by W.

11 Virgins Spike is a ſtarre of the firſt bignes, hauing South declination, 9. degrées riſing Eaſt and by South, and ſetting Weſt and by South.

12 Betwixt both thighes is a ſtarre of the firſt bignes, hauing 21. degrees, 20. minutes, of North declination, and riſeth Northeaſt Eaſterly, ſetting northweſt weſterly.

13 South Ballance is a ſtarre of the ſecond bigneſſe, whoſe declination is 14. degrees, 14. minutes ſoutherly, riſing Eaſt, Southeaſt, and ſetteth weſt S. weſt.

14 Scorpions heart is a ſtarre of the firſt bigneſſe, hauing ſouth declination, 25. degrees, 25. minutes, riſing S. Eaſt, and ſetting S. weſt.

15 The Eagles heart is a ſtarre of the ſecond bigneſſe, hauing 7. degrées 54. minutes of North declination, riſing Eaſt and by North, and ſetting weſt and by North.

16 Pegaſus ſhoulders is a ſtarre of the ſecond bigneſſe, whoſe declination is 12. degrees, 58. minutes, northerly, riſing

ting E. N. E, and setting W. N. W.

17 The Swans tayle is a ſtarre of the ſecond bignes whoſe declination is 43. degrees, 54. minutes northerly, nat ſetting at all in our Horizon.

18 The Wagoners right ſhoulder is a ſtarre of the ſecond bigneſſe, whoſe declination is 44. degrees. 49. minutes, north, alwayes aboue our Horizon.

19 Hircus the Goate is a ſtarre of the firſt bignes, hauing north declination, 45. degrees, 50 minutes, neyther riſing nor ſetting in our Horizon.

20 Lyra is a ſtarre of the firſt bignes, hauing north declination 38. degrees, 30. minutes, not riſing nor ſetting in our Horizon.

31 Perſeus right ſide is a ſtarre of the ſecond bigneſſe, whoſe declination is 48. degrees, 22. minutes, not riſing nor ſetting.

22 Fomahand is a ſtarre of the firſt bignes, hauing ſouth declination, 33 degrees, 15. minutes, riſing S. E. and by S. and ſetting S. W. and by S.

Theſe other ſtarres following, neyther riſe nor ſet in our Latitude.

23 In the great Beares thigh is a ſtarre of the ſecond bigneſſe, whoſe declination is 55. degrees, 58. minutes, northerly.

24 In the great Beares ſide is a ſtarre of the ſecond bignes, hauing declination northerly, 58. degrees, 34. minutes.

25 In her backe is alſo a ſtarre of the ſecond bigneſſe, whoſe declination northerly is 63 degrees, 55. minutes.

26 The formoſt guarde is a ſtarre of the ſecond bignes, hauing declination towards the north pole 75. degrees, 49 minutes.

27 The pole ſtarre is of the third bignes, hauing North declination, 87 degrees, 8. minutes.

A Table of the time of the foreſaide ſtarres, comming to the meridian.

	Rams horne.		Bulles Eye.		Orion l. foote		Orion r. shoulder		First in Or. gir.		Great Dogge.		Little Dogge.		brightin hydra.		Lions heart.	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.
5	5 A	45	8 A	26	9 A	8	9 A	47	9 A	25	10 A	40	11 A	31	1 B	21	2 B	16
10	5	24	8	5	8	47	9	26	9	4	10	19	11	10	1	0	1	49
15	5	2	7	43	8	25	9	4	8	42	9	57	10	48	0	38	1	27
20	4	42	7	23	8	5	8	44	8	22	9	37	10	28	0	18	1	7
25	4	21	7	2	7	44	8	23	8	1	9	16	10	7	11 A	57	0	46
30	4	1	6	42	7	24	8	3	7	41	8	56	9	47	11	37	0	26
5	3	38	6	19	7	1	7	40	7	18	8	33	9	24	11	14	0	3
10	3	18	5	59	6	41	7	20	6	58	8	13	9	4	10	59	11 A	43
15	3	0	5	41	6	23	7	2	6	40	7	55	8	46	10	36	11	25
20	2	40	5	21	6	3	6	42	6	22	7	35	8	26	10	16	11	5
25	2	22	5	3	5	45	6	24	6	2	7	17	8	8	9	58	10	47
30	2	10	4	51	5	33	6	12	5	50	7	5	7	56	9	36	10	35
5	1	52	4	33	5	15	5	54	5	32	6	47	7	38	9	28	10	17
10	1	34	4	15	4	57	5	36	5	14	6	29	7	20	8	59	9	59
15	1	16	3	57	4	39	5	18	4	56	6	11	7	2	8	41	9	41
20	0	57	3	38	4	20	4	59	4	37	5	52	6	43	8	23	9	22
25	0	39	3	20	4	2	4	41	4	19	5	34	6	25	8	5	9	4
30	0	21	3	0	3	44	4	22	4	1	5	16	6	7	7	47	8	45
5	11 B	59	2	43	3	22	4	3	3	39	4	54	5	45	7	28	8	24
10	11	41	2	22	3	4	3	43	3	21	4	36	5	27	7	8	8	6
15	11	22	2	3	2	45	3	24	3	2	4	17	5	8	6	47	7	47
20	11	2	1	43	2	25	3	4	2	42	3	57	4	48	6	27	7	27
25	10	44	1	25	2	7	2	46	2	24	3	39	4	30	6	7	7	9
30	10	25	1	6	1	48	2	27	2	5	3	20	4	11	5	51	6	50
5	10	5	0	46	1	28	2	7	1	45	3	0	3	51	5	41	6	30
10	9	46	0	27	1	9	1	48	1	26	2	41	3	32	5	22	6	11
15	9	25	0	6	0	48	1	27	1	5	2	20	3	11	5	1	5	50
20	9	5	11 B	46	0	28	1	7	0	45	2	0	2	51	4	41	5	30
25	8	45	11	26	0	8	0	47	0	25	1	40	2	31	4	21	5	10
30	8	25	11	6	11 B	52	0	27	0	5	1	20	2	11	4	1	4	54
5	8	1	10	42	11	24	0	3	11 B	41	0	56	1	47	3	37	4	26
10	7	39	10	20	11	2	11 B	41	11	19	0	34	1	25	3	15	4	4
15	7	19	10	0	10	42	11	21	10	59	0	14	1	5	2	55	3	44
20	6	58	9	39	10	25	11	0	10	38	11 B	53	0	44	2	34	3	23
25	6	37	9	18	10	0	10	39	10	17	11	32	0	23	2	13	3	2
30	6	17	8	58	9	40	10	19	9	57	11	12	0	3	1	53	2	42

January. February. March. April. May. June. July. August. September October. November. December.

		Rams horne.		Bulles Eye.		Orion l. foote.		Orion r. shoulder		First in Or. gir.		Great Dogge.		Little Dogge.		bright It in hydra		Lions heart.	
		H.	M.	H.	M.	H.	M	H.	M.	H.	M.	H.	M	H.	M.	H.	M.	H.	M.
July.	5	5 B	57	8 B	38	9 B	20	9 B	59	9 B	37	10 B	52	11 B	43	1 A	33	2 A	22
	10	5	36	8	17	8	59	9	38	9	16	10	31	11	22	1	12	2	1
	15	5	16	7	57	8	39	9	18	8	56	10	11	11	20	0	52	1	41
	20	4	57	7	38	8	20	8	59	8	37	9	52	10	43	0	33	1	22
	25	4	37	7	18	8	0	8	39	8	17	9	32	10	23	0	13	1	2
	30	4	17	6	58	7	40	8	19	7	57	9	12	10	3	11 B	53	0	42
August.	5	3	56	6	37	7	19	7	58	7	42	8	51	9	42	11	32	0	21
	10	3	36	6	17	6	59	7	38	7	24	8	31	9	22	11	12	0	1
	15	3	17	5	58	6	40	7	19	7	5	8	12	9	3	10	53	11 B	42
	20	2	59	5	40	6	22	7	1	6	47	7	54	8	41	10	35	11	24
	25	2	41	5	22	6	4	6	39	6	29	7	36	8	27	10	17	11	6
	30	2	23	5	4	5	46	6	19	6	10	7	18	8	6	9	59	10	48
September	5	2	4	4	43	5	25	6	4	5	53	6	57	7	48	9	38	10	27
	10	1	44	4	25	5	7	5	46	5	34	6	39	7	30	9	20	10	9
	15	1	15	4	6	4	48	5	27	5	15	6	20	7	11	9	1	9	50
	20	1	7	3	48	4	30	5	9	4	55	6	2	6	53	8	43	9	32
	25	0	49	3	26	4	12	4	51	4	36	5	44	6	35	8	25	9	14
	30	0	30	3	11	3	53	4	32	4	15	5	25	6	16	8	6	8	55
October.	5	0	13	2	54	3	36	4	15	3	55	5	8	5	59	7	49	8	38
	10	11 A	54	2	35	3	17	3	56	3	34	4	49	5	48	7	30	8	19
	15	11	35	2	16	2	58	3	37	3	15	4	30	5	21	7	11	8	0
	20	11	15	1	56	2	38	3	17	2	55	4	10	5	1	6	51	7	40
	25	10	56	1	37	2	19	2	58	2	36	3	51	4	42	6	32	7	21
	30	10	35	1	16	1	58	2	37	2	15	3	30	4	21	6	11	7	0
November.	5	10	11	0	52	1	34	2	13	1	51	3	6	3	57	5	47	6	36
	10	9	50	0	31	1	13	1	52	1	30	2	45	3	36	5	26	6	15
	15	9	29	0	10	0	52	1	31	1	9	2	24	3	15	5	5	5	54
	20	9	8	11 A	49	0	31	1	10	0	48	2	3	2	54	4	45	5	33
	25	8	46	11	27	0	9	0	48	0	26	1	41	2	32	4	25	5	11
	30	8	24	11	5	11 A	47	0	26	0	4	1	19	2	10	4	0	4	49
December.	5	8	2	10	43	11	25	0	4	11 A	42	0	57	1	48	3	38	4	27
	10	7	40	10	21	11	3	11 A	42	11	20	0	35	1	26	3	18	4	5
	15	7	18	9	59	10	41	11	20	10	58	0	13	1	4	2	54	3	43
	20	6	56	9	37	10	19	10	58	10	36	11 A	51	0	42	2	32	3	21
	25	6	33	9	14	9	56	10	35	10	13	11	28	0	19	2	9	2	58
	30	6	11	8	52	9	34	10	13	9	51	11	6	11 A	57	1	47	2	36

	Lions tayle.		Virgins Spike.		Boots thigh.		South ballāce		Scorpiō heart.		Eagles heart.		Pegasus shoulder		Swans tayle.		wagoner shoulder	
	H.	M	H.	M	H.	M	H.	M	H.	M	H.	M	H.	M	H.	M	H.	M
Ianuarie.	5	3 B	42	5 B	18	6 B	9	6 B	43	8 B	19	11 B	45	2 A	59	0 A	43	9 A	43
	10	3	21	4	57	5	48	6	22	7	58	11	24	2	38	0	22	0	22
	15	2	59	4	35	5	26	6	0	7	36	11	2	2	16	0	c	9	0
	20	2	39	4	15	5	6	5	40	7	16	10	42	1	56	11 B	40	8	40
	25	2	18	3	54	4	45	5	19	6	55	10	21	1	35	11	19	8	19
	30	1	58	3	34	4	25	4	59	6	35	10	1	1	11	10	59	7	59
Februarie.	5	1	35	3	11	4	2	4	36	6	12	9	48	0	52	10	36	7	36
	10	1	15	2	51	3	42	4	16	5	52	9	18	0	32	10	16	7	16
	15	0	57	2	33	3	24	3	58	5	34	9	0	0	14	9	58	6	58
	20	0	37	2	12	3	4	3	38	5	14	8	40	11 B	54	9	38	6	38
	25	0	19	1	55	2	46	3	20	4	56	8	22	11	36	9	20	6	20
	28	0	7	1	43	2	34	3	8	4	44	8	10	11	24	9	8	6	8
March.	5	11 A	49	1	25	2	16	2	50	4	26	7	52	11	6	8	50	5	50
	10	11	31	1	7	1	58	2	32	4	8	7	34	10	48	8	32	5	32
	15	11	13	0	49	1	40	2	14	3	50	7	16	10	30	8	14	5	14
	20	10	54	0	30	1	21	1	55	3	31	6	57	10	11	7	55	4	55
	25	10	36	0	12	1	3	1	37	3	13	6	39	9	53	7	37	4	37
	30	10	18	11 A	54	0	45	1	19	2	55	6	21	9	35	7	19	4	19
Aprill.	5	9	56	11	32	0	23	0	57	2	33	5	59	9	13	6	57	3	57
	10	9	38	11	14	0	5	0	39	2	15	5	41	8	55	6	39	3	39
	15	9	19	10	55	11 A	46	0	20	1	56	5	22	8	36	6	20	3	20
	20	8	59	10	35	11	26	0	0	1	36	5	2	8	16	6	0	3	0
	25	8	41	10	17	11	8	11 A	42	1	18	4	44	7	58	5	42	2	42
	30	8	22	9	58	10	49	11	23	0	59	4	25	7	39	5	23	2	23
May.	5	8	2	9	38	10	29	11	3	0	39	4	5	7	19	5	3	2	3
	10	7	43	9	19	10	10	10	44	0	20	3	46	7	0	4	44	1	44
	15	7	22	8	58	9	49	10	23	11 A	59	3	25	6	39	4	23	1	23
	20	7	2	8	38	9	29	10	3	11	39	3	5	6	19	4	3	1	3
	25	6	42	8	18	9	9	9	43	11	19	2	45	5	59	3	43	0	3
	30	6	22	7	58	8	49	9	23	10	59	2	25	5	39	3	23	0	23
June.	5	5	58	7	34	8	25	8	59	10	35	2	1	5	15	2	59	0	0
	10	5	36	7	12	8	3	8	37	10	13	1	39	4	53	2	37	11 B	37
	15	5	16	6	52	7	43	8	17	9	53	1	19	4	33	2	17	11	17
	20	4	55	6	31	7	26	7	56	9	32	0	58	4	12	1	56	10	56
	25	4	34	6	10	7	1	7	35	9	11	0	37	3	51	1	3	10	35
	30	4	14	5	50	6	41	7	15	8	51	0	17	3	31	1	15	10	15

		Lions tayle.		Virgins Spike.		Boots thigh.		South Ballance		Scorpiō heart.		Eagles heart.		Pegasus shoulder		Swans tayle.		Wagoner shoulder	
		H.	M.	H.	M.	H.	M.	H.	M	H.	M.	H.	M.	H.	M	H.	M.	H.	M.
July.	5	3	A 54	5	A 30	6	A 2	1 6	A 55	9	A 31	11	A 57	3	B 11	0	B 55	9	B 55
	10	3	33	5	9	6		0 6	34	9	10	11	36	2	50	0	34	9	34
	15	3	13	4	49	5	4	0 6	14	8	50	11	16	2	30	0	14	9	14
	20	2	54	4	30	5	2	1 5	55	8	31	10	57	2	11	11	A 55	8	55
	25	2	34	4	10	5		1 5	35	8	11	10	37	1	51	11	35	8	35
	30	2	14	3	50	4	4	1 5	14	7	51	10	17	1	31	11	15	8	15
August.	5	1	53	3	29	4	2	0 4	54	7	30	9	56	1	10	10	54	7	54
	10	1	33	3	9	4		0 4	34	7	10	9	36	0	50	10	34	7	34
	15	1	14	2	50	3	4	1 4	15	6	51	9	17	0	31	10	14	7	14
	20	0	56	2	32	3	2	1 3	57	6	33	8	59	0	13	9	57	6	57
	15	0	38	2	14	3		0 3	39	6	15	8	41	12	A 55	9	39	6	39
	30	0	20	1	56	2	4	0 3	21	5	57	8	23	11	37	9	21	6	21
September.	5	11	B 59	1	35	2	2	6 3	0	5	36	8	2	11	16	9	0	6	0
	10	11	41	1	17	2		8 2	42	5	18	7	44	10	58	8	42	5	42
	15	11	22	0	58	1	4	9 2	23	4	59	7	25	10	39	8	23	5	23
	20	11	4	0	40	1	2	1 2	5	4	41	7	7	10	21	8	5	5	5
	25	10	46	0	22	1		1 3	47	4	23	6	49	10	3	7	47	4	47
	30	10	27	0	3	0	4	1 4	28	4	4	6	30	9	44	7	28	4	28
October.	5	10	10	11	B 35	0	2	1 4	11	3	47	6	13	9	27	7	11	4	11
	10	9	51	11	27	0		1 0	52	3	28	5	54	9	8	6	52	3	52
	15	9	32	11	8	11	2	B 59	33	3	9	5	35	8	49	6	33	3	33
	20	9	12	10	48	11		3 9	13	2	49	5	15	8	29	6	13	3	13
	25	8	53	10	29	11	4	2 0	54	2	30	4	56	8	10	5	54	2	54
	30	8	32	10	8	10		2 9	33	2	9	4	35	7	49	5	33	2	33
November.	5	8	8	9	44	10	2	2 8	9	1	45	4	11	7	25	5	9	2	9
	10	7	47	9	23	10		2 8	48	1	24	3	50	7	4	4	48	1	48
	15	7	26	9	2	9	4	2 7	27	1	3	3	29	6	43	4	27	1	27
	20	7	5	8	41	9		2 7	6	0	42	3	8	6	22	4	6	1	6
	25	6	43	8	19	9	4	2 6	44	0	20	2	46	6	0	3	44	0	44
	30	6	21	7	57	8		2 6	22	11	B 58	2	24	5	38	3	22	0	22
December.	5	5	59	7	35	8	2	2 6	0	11	36	2	2	5	16	3	0	0	0
	10	5	37	7	13	8		2 5	38	11	14	1	40	4	54	2	38	11	A 38
	15	5	15	6	51	7	4	2 5	16	10	52	1	18	4	32	2	16	11	16
	20	4	53	6	29	7	2	2 4	54	10	30	0	56	4	10	1	54	10	54
	25	4	30	6	6	6		2 4	31	10	7	9	33	3	47	1	31	10	31
	30	4	8	5	44	6	4	2 3	9	9	45	0	11	3	25	1	9	10	9

	Hircus.		Lyra.		Perſeus r. ſide.		Foma hand.		g. Beares thigh.		Beares ſide.		Beares backe.		formoſt Guarde		Pole ſtarre:	
	H.	M	H.	M	H.	M	H.	M	H.	M	H.	M	H.	M	H.	M	H.	M.
	5	9 A	2	10 B	33	7	A 9	2	A 53	3	B 45	2	B 51	2	B 53	7	B 7	5 A 3
	10	8	41	10	12	6	48	2	32	3	24	2	30	2	32	6	46	4 42
	15	8	19	9	50	6	26	2	10	3	2	2	8	2	10	6	24	4 20
	20	7	59	9	30	6	6	1	50	2	42	1	48	1	50	6	4	4 0
	25	7	38	9	9	5	45	1	29	2	21	1	27	1	29	5	43	3 39
	30	7	18	8	41	5	25	1	9	2	1	1	7	1	9	5	23	3 19
	5	6	55	8	26	5	2	0	46	1	38	0	44	0	46	5	0	2 56
	10	6	35	8	6	4	42	0	26	1	18	0	24	0	26	4	40	2 36
	15	6	17	7	48	4	24	0	8	1	0	0	6	0	8	4	22	2 18
	20	5	57	7	28	4	4	11 B	48	0	40	11	A 46	11	A 48	4	2	1 58
	25	5	39	7	10	3	46	11	30	0	22	11	28	11	30	3	44	1 40
	28	5	27	6	58	3	34	11	18	0	10	11	16	11	18	3	32	1 28
	5	5	9	6	40	3	16	11	0	11	A 52	10	58	11	0	3	14	1 10
	10	4	51	6	22	2	58	10	42	11	44	10	40	10	42	2	56	0 52
	15	4	33	6	4	2	40	10	24	11	16	10	22	10	24	2	38	0 34
	20	4	14	5	45	2	21	10	5	10	57	10	3	10	5	2	19	0 15
	25	3	56	5	27	2	3	9	47	10	39	9	45	9	47	2	0	11 B 57
	30	3	38	5	9	1	45	9	29	10	21	9	27	9	29	1	43	11 39
	5	3	16	4	47	1	23	9	7	10	0	9	5	9	7	1	21	11 17
	10	2	58	4	29	1	5	8	49	9	41	8	47	8	49	1	3	10 58
	15	2	39	4	10	0	46	8	30	9	22	8	28	8	30	0	44	10 40
	20	2	19	3	50	0	26	8	10	9	2	8	8	8	10	0	24	10 20
	25	2	1	3	32	0	8	7	52	8	44	7	50	7	52	0	6	10 2
	30	1	42	3	13	11 B	49	7	33	8	25	7	31	7	33	11	A 47	9 43
	5	1	22	2	53	11	29	7	13	8	5	7	11	7	13	11	27	9 23
	10	1	3	2	34	11	10	6	54	7	46	6	52	6	54	11	8	9 4
	15	0	42	2	13	10	49	6	33	7	25	6	31	6	33	10	47	8 43
	20	0	22	1	53	10	29	6	13	7	5	6	11	6	13	10	27	8 22
	25	0	2	1	33	10	9	5	53	6	45	5	51	5	53	10	7	8 2
	30	11 B	42	1	13	9	49	5	33	6	25	5	31	5	33	9	47	7 15
	5	11	18	0	49	9	25	5	10	6	2	5	7	5	10	9	23	7 19
	10	10	56	0	27	9	3	4	47	5	39	4	45	4	47	9	1	6 57
	15	10	36	0	7	8	43	4	27	5	19	4	23	4	27	8	41	6 37
	20	10	15	11	A 46	8	22	4	6	4	58	4	4	4	6	8	20	6 16
	25	9	54	11	25	8	1	3	45	4	37	3	45	3	43	8	0	5 55
	30	9	34	11	5	7	41	3	25	4	17	3	23	3	25	7	39	5 35

Ianuarie. Februarie. March. April. May. June. July. August. September. October. November.

	Hircus.		Lyra.		Perſeus r: ſide.		Foma- hand.		g. Beares thigh.		Beares ſide.		Beates Backe.		Formoſt Guarde		Pole Starre.	
	H.	M.	H.	M.	H.	M.	H.	M	H.	M.	H.	M.	H.	M	H.	M	H.	M.
	5 9	B 14	10	A 45	7	B 21	3	B 5	3	A 57	3	A 3	3	A 5	7	A 19	5	B 15
	10 8	53	10	24	7	0	2	44	3	36	2	42	2	44	6	58	4	54
July.	15 8	33	10	4	6	40	2	24	3	16	2	22	2	24	6	38	4	34
	20 8	14	9	45	6	21	2	5	2	57	2	3	2	5	6	19	4	15
	25 7	54	9	25	6	0	1	45	2	37	1	43	1	45	5	58	3	55
	30 7	34	9	5	5	41	1	25	2	17	1	23	1	25	5	39	3	35
	5 7	13	8	44	5	20	1	4	1	56	1	2	1	4	5	18	3	14
	10 6	53	8	24	5	0	0	44	1	36	0	44	0	44	4	58	2	54
August.	15 6	34	8	5	4	11	0	15	1	17	0	25	0	25	4	49	2	35
	20 6	16	7	47	4	23	0	7	0	58	0	7	0	7	4	21	2	17
	25 5	58	7	29	4	5	11	A 49	0	46	11	B 49	11	B 49	4	3	1	59
	30 5	40	7	11	3	47	11	31	0	23	11	31	11	31	3	45	1	41
	5 5	19	6	50	3	26	11	10	0	2	11	8	11	10	3	24	1	20
	10 5	0	6	32	3	8	10	52	11	B 44	10	50	10	52	3	6	1	0
September.	15 4	42	6	13	2	49	10	33	11	25	10	31	10	33	2	47	0	43
	20 4	24	5	59	2	31	10	15	11	7	10	13	10	15	2	29	0	25
	25 4	6	5	37	2	13	9	57	10	49	9	55	9	57	2	11	0	7
	30 3	47	5	18	1	54	9	38	10	30	9	36	9	38	1	52	11	A 48
	5 3	30	5	0	1	37	9	21	10	13	9	16	9	21	1	35	11	31
	10 3	11	4	42	1	18	9	2	9	54	9	0	9	2	1	16	11	12
October.	15 2	52	4	23	0	59	8	43	9	35	8	41	8	43	0	57	10	53
	20 2	32	4	3	0	39	8	23	9	15	8	21	8	23	0	37	10	33
	25 2	13	3	44	0	20	8	4	8	56	8	2	8	4	0	28	10	14
	30 1	52	3	23	0	0	7	43	8	35	7	41	7	43	11	B 58	9	53
	5 1	28	3	0	11	A 35	7	19	8	11	7	17	7	19	11	33	9	29
	10 1	7	2	38	11	14	6	58	7	50	6	56	6	58	11	12	9	8
November.	15 0	46	2	17	10	53	6	39	7	29	6	35	6	37	10	51	8	47
	20 0	25	1	56	10	32	6	16	7	8	6	14	6	16	10	30	8	26
	25 0	3	1	34	10	10	5	54	6	46	5	52	5	54	10	8	8	4
	30 11	A 41	1	12	9	48	5	32	6	24	5	30	5	32	9	46	7	42
	5 11	16	0	50	9	26	5	10	6	2	5	8	5	10	9	24	7	17
	10 10	57	0	= 28	9	4	4	48	5	40	4	46	4	48	9	2	6	58
December.	15 10	35	0	6	8	42	4	28	5	18	4	26	4	28	8	40	6	36
	20 10	13	11	B 44	8	20	4	4	4	56	4	2	4	4	8	18	6	14
	25 9	50	11	21	7	57	3	41	4	33	3	39	3	41	7	55	5	51
	30 9	28	11	0	7	35	3	19	4	11	3	17	3	19	7	33	5	29

The vse of which former Table for finding of any the saide starres time of comming to the meridian being in number 27. is thus, looke for the name of the starre at the head of the Table, and for the moneth at the side thereof, toward the right hand, the dayes of the said monthes, there against being numbred, from 5. to 5. and right against the day therof, vnder the starres name, is the howre and minute that the saide starre comes to the Meridian, eyther before or after noone, the day and moneth desired, which to know whether it be before or after noone, is noted by two letters, A. and B. for if the letter A. stand with or next before the numbers, it signifieth so many howres and minutes after Noone, and if B. stand therewith, or next before, then it signifieth so much before noone, or after midnight, as for example. The 10. of Februarie, I desire to know, at what time the South Wallance will bee vpon the meridian. First, I looke for the name of the said starre in the head of the Table, and at the right hand thereof: for the 10. of Februarie, right against which vnder the starres name, I find 4. howres, 16. minutes, and the letter next before the same, is B. So I conclude that the south Wallance shall be vpon the Meridian at 4. a clocke and 16. minutes before noone, the day and moneth aforesaid.

Againe the 15. of September, I desire to know at what time the shoulder of Pegasus will bee vpon the meridian, against the 15. of September, vnder the name of Pegasus shoulder, is 10. howres, 39. minutes, and the letter next before is A. therefore I say that at 10. of the clocke and 39. minutes after noone, the said starre shall bee vpon the meridian, the day and moneth aforesaid.

This is plaine enough, from 5. to 5. dayes of euerie moneth, but if you desire the like for euery day particularly of any moneth, as indeed it is very requisite, you see that the difference betwixt euery 5. day noted in the Table, is neare about 20 minutes, which is euery day 4. minutes that the starre comes to the meridian sooner then other, and therefore if you take away for euery day that you are from the

day

day next before in the table noted foure minutes, the remainder shewes your desire.

Example.

The seuententh of September, I desire the time of Pegasus, as before, and finding not the 17. day in the table I take the next before, being the fifteenth. From whose number, being tenne howers thirtie nine minutes, I take away for two dates, the difference betwixt the fiftenth and the seuententh, eight minutes, so there rests ten howres 31. minutes for the said stars comming to the meridian, the saide seuentéenth of September, &c.

CHAP. XII.

Of the composition and vse of an instrument, by the which without obseruing the South Sun, or midday, is knowne the altitude of the pole, and the houre that is.

WE haue giuen rules, whereby the Pilot may know in what paralell he findeth himselfe with his Ship. But he may not know this at all houres, for as much as for the altitudes of the Sun it is necessarie to obserue the midday iustly, and for the altitudes of the North, it is necessarie to obserue, that the formost guard bee placed iustly with the North in some of the foure lines of the eight winds. And ouer and beside the rules aforesaid, I haue thought good to describe an instrument, by the which may bee knowne the paralell where the Shippe is, and what the houre is at any time of the day by the beames of the Sunne.

Make a round plate of latyn, or other conuenient mettall of the Diameter of a spanne or more: for the greater that it is, the more precise shall it be, and make in it two diameters, that may cut themselues in right angles vpon the center: In the foure extreames or ends of these Diameters, leaue foure round punctes or poyntes, that may serue for axis The one of these Diameters shall bee called the axis of the world, and the other, the line of East and West. This done, make

make of the same latyn or semicirculer peece of the thicknesse of the plate, or little lesse, & of the breadth of halfe a finger, this must stand vpon an edge, so that the conuex part may come iustly with the halfe of the circumference of the plate, to the which it must be nayled or sothered in the neather part of the plate, the semicircle being rayled, and that the ends therof may come with the ends of the Axis of the world: and this semicircle shall you diuide into two equall parts, and euerie halfe into 90. degrees, beginning from the halfe point toward the end of the Axis of the world, which are the Poles.

In like maner shal you make 2 circular peeces of the bignes of a peece of foure royals of plate, which they cal rundels for the howres: these must bee made fast in the plate by the poles of the world, which may hold or beare them by their centers: and euery of these rundels must be diuided into 24. equall parts, and although not all, yet the vppermost part of the plate: and aboue in the highest point of these diuisions, you must write 12, because that there it shall shew the midday or noone, and from thence, the afternoone howres must begin their numbers toward the west part. and shall end fiue howres in the halfe or middest of the ioynt of the circle with the plate: in the other ioynt of the other part, shall begin 6 of the howres before noone, & shall end 12 in the highest point. You must also make an other semicircular peece of the breadth of a finger, this must be plain or flat, & the concaue or holownesse thereof equall to the semicircle of the edge or side of the plate, & in the ends must haue 2 holes, wherin may iustly enter the points that come forth of the circle for ỳ houres which are the poles of the world, also this semicircle must haue two lines, one on the vppermost part, & the other on the neathermost, which may diuide the breadth into two equall partes: this halfe circle likewise must be diuided into 2. equall parts, by longitude with a trauersed line, which shalbe called the Equinoctial, & from this line to the inward part thereof must be counted 13. degrees & a halfe toward the one part, and as much toward the other part of the 90. that euery halfe of the circle containeth, and at euery part where end the 23.

degrees

degrees and a halfe, make a trauerſed line, ſo that from the one to the other, may be 47. degrees. And in this ſpace ſhall you drawe certaine lines equidiſtant with them of the mydeſt, that they and the middle line, may deuide into 4. equall parts the breath of the halfe circle. Then looke in the table of the declinations of the ſunne, what declination hath the 5. degree of Aries, and that ſhall you account from the Equinoctiall toward the one parte, and as much more toward the other, making a line that may reuerſe that of the mydeſt, where that declination doth ende and touch in the other two lines. And the ſame ſhall you doo at 10. 15. 20: 25, and 30. which is the ende of Aries, and beginning of Taurus, and then the line ſhall trauerſe all the breadth: The like alſo ſhall you doe to Taurus and Gemini, then in the ſpaces write caracts of the xii ſignes, beginning Aries from the Equinoctiall, toward the north pole. And then do Taurus and Gemini ende in the greateſt declination, beginning Cancer in the other part of it, Then Leo and Virgo doe ende in the Equinoctial, where ſhall begin Libra, Scorpio, Sagittarius: and in the other part, Capricornus, Aquarius, and Piſces, ſhall ende in the Equinoctiall where Aries began: this halfe circle muſt haue an opening or open place, euen and iuſt in the middeſt from the Equinoctiall, vnto ſomewhat more then the greateſt declinations, and muſt be a little broader on the inner part then without, & not ſo broad as may com to the two lines, becauſe it would then take away the graduation of the ſignes: and in this open place muſt be put a ſquare graine or ſtubbe, which on the inner part may come plaine with the halfe circle, and on the vtter part may come forth a litle, where ſhalbe naild a ſquare peece of latyn, of the breadth of the halfe circle: this graine or ſtubbe being ſo nayled with a peece, muſt haue in the mideſt a hole, ſo ſmall, as may receiue a little pinne, and by the center of this hole, muſt paſſe a line, which ſhall trauerſe all the graine: and this line ſhall ſerue to put the ſunne, (which the hole repreſenteth) in the degree of the ſigne where it is: This halfe Circle where it goeth in the cir-

circumference of the rundels, for the howres must be filed on the one side vnto the line that is in the middest, to marke it, and shew the number of it. For the placing or setting of this Instrument, you must cut a girdle, or ring of latyn, as thick as the plate, and of the breadth of a finger, or little lesse, and so large, that of it may bee made a circle somewhat bigger then the plate, so that the plate and the Meridian may easily bee contained within it. This circle shall be called the Horizon, which must be diuided into foure quarters.

In like manner must be made two semicircular peeces and the ends of them must be nayled or sothered in the points that diuide the quarters of the Circle, and diuide the one from the other in two equall partes, making right Sphericall Angles and in this ioynt of these two peeces, must bee nayled or sothered a Wastell, the which at the one end is diuided into two branches or forkes. Then shall you make a base or foot for the same, which in the vppermost part thereof shall haue a concauity, or hollownesse, where may be set a sayling compasse or a needle, touched with the Load-stone, and couered ouer with a glasse. And on the highest edges of this base the two branches of the Wastell shall be made fast, and this base with the Wastell, the halfe circle and the circle, shall be all one peece, which shall be called the seate or frame of the Instrument. The Horizontall Circle in the endes of one halfe Circle, must haue two holes, in the which may enter the arts that are made in the ends of the line of east & west.

Also you must take good heed when you sother or make fast the Wastell in the base, that the north and south of the plate or Horizon, come with the north and south of the needle that is beneath, hauing euer respect how much the needle doth vary from the meridian, by North-eastting or northwesting. In the ioynt of the two halfe circles vpon the Wastell, must be a point (called the inder or shewer) which shall shew in the halfe Circle, sothered in the place on the neather part, the degrees that the Pole is rayled aboue the Horizon.

For the perfection of this Instrument, it shall be conue-

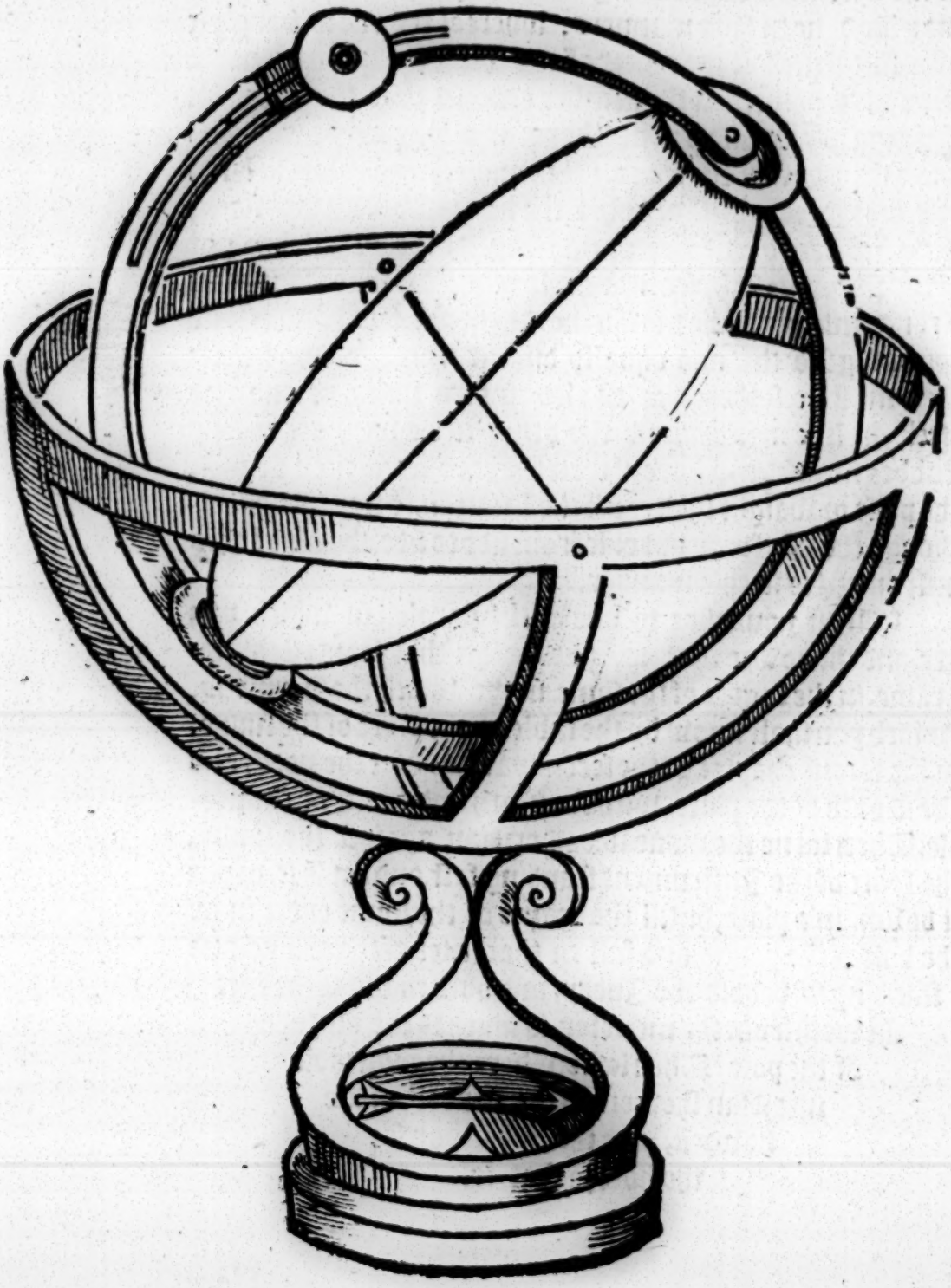
nient

nient to set the Horizon very plaine and equall at the time of the operation or practising with the Instrument, and this may bee done in two manners, whereof the one is, hanging by a fine threed at the center of the plate, a plomet made somewhat pointed at the neather end, so that the Horizon standing plaine and leuell, the point of the plomet may fall vpon the point of the inder, & this maner is good for the land; but for the sea, you shal lother the horizon with two Ares, little stubbes or ends comming forth: these shall bee put in the two opposit holes of a circle of mettal made somwhat strong, and this circle must haue other two stubbes likewise comming forth, and equally distant from the two holes: these must be sothered or nayled in two holes of another circle in like manner, and the other circle with other two stubbes inclosed in a bore, if then the bore stand euen & leuell, the poise or waight shall cause the Horizon to stand leuell, although the ship sway or roule from side to side, the vse of this instrument is in this manner.

When you desire to know the paralell in which you are, and the howre that is, put the line that trauerseth the graine, in the degree of the signe in the which the Sunne is, (which you shall know by the table of the place of the sunne, in the second chapter of the second part) and set the north and the South of the plate, with the north and south of the needle. Then turne the moueable Meridian against the sunne, the foote of the Instrument standing fast, and rayse it, or put it downe in a plate, vntill the beame of the sunne enter in at the hole of the grane, and fall in the center of the graine, and standing so, behold the Inder, and how many degrees it sheweth from the meridian, so much is the altitude of the pole. Then looke where the moueable meridian sheweth in the roundell of the howres, and there shall you see the howre that is.

Here

Here followeth the Demonſtration:



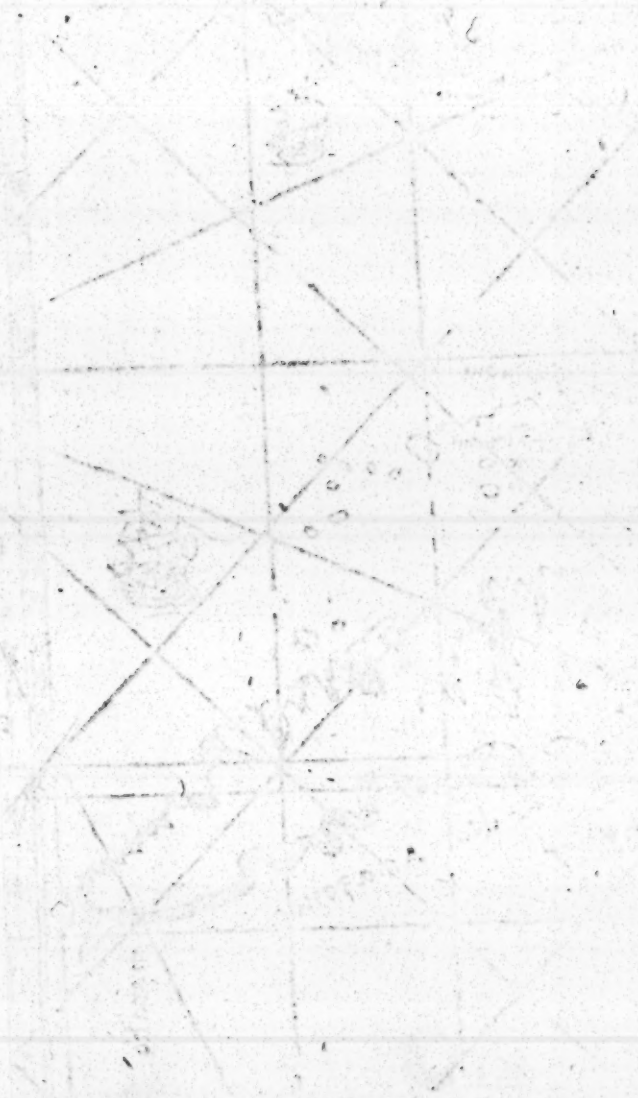
CHAP. XIII.

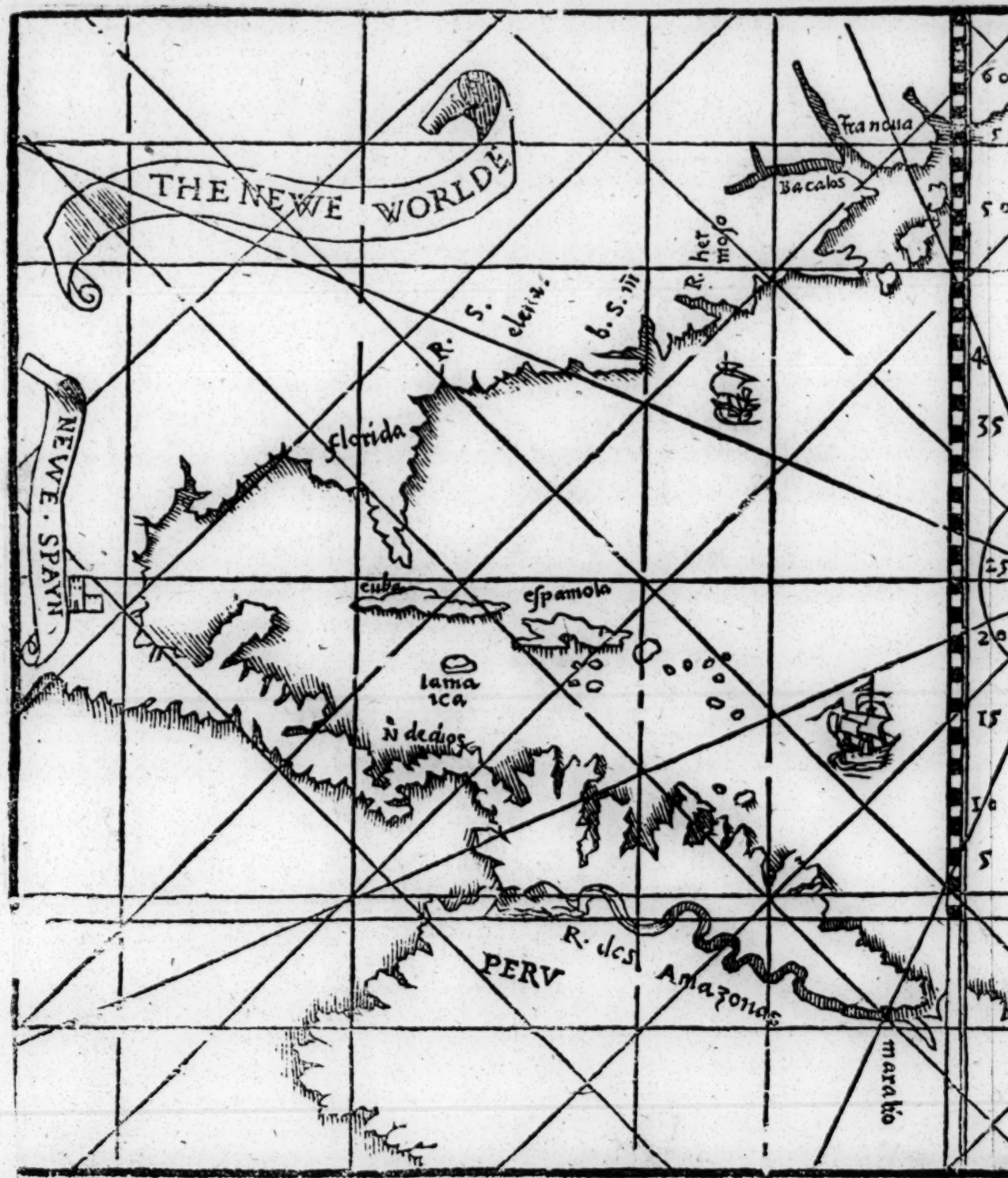
Shewing how many leagues must bee runne vpon euerie seuerall part of the compasse to raise or lay one degree of latitude, and also how much you are departed from the first meridian in raysing or laying one Degree vpon any of the said points.

THis matter had Martin Curtis here well explayned, and set downe a demonstration thereof, but indeede onely according to the account of Spanish leagues, which being then well knowne vnto our Mariners, for that many of them did sayle and keepe their reckonings by Spanish charts, caused the Translator of this worke (Richard Eden) not to alter his demonstration, nor to swerue any whit from his direction therein, but now considering that our owne country descriptions of maps and chartes, are brought to such a perfection, as in my conceite no nation hath the like for true and perfect delineation, and our skale of leagues being dissonant from the Spanish (vz) theirs consisting of 17. ½. leagues to a degree, and ours of 60. leagues, to a degree, I thought it better to set downe that way, which is most familiar, then by any vncouth or strange way to bring them into a Labyrinth, albeit that I doe acknowledge their account, and ours to be all one, their 17 leagues, and ½. containing 60. minutes, or one degree of a great circle, and so likewise doth 20. of our leagues, onelie ours of 20. leagues to a degree, is more easie and conducible then theirs, to bee reduced into any denomination, whatsoeuer: howbeit I purpose God willing in this chapter to shew how to reduce English, Spanish, and Dutch Leagues, out of one forme into another, in the meane time, for the vnderstanding of what is formerlie promised, know that running East or West, you neither raise nor lay the Pole, but it is still of one and the same

height vnto you, in whatsoeuer Meridian you are: likewise if you sayle north or south, you neuer alter your longitude, but if you be to the northward of the Equinoctiall, euery 20 leagues that you sayle to the southwardes, doth lay or depresse the North pole one degree, and so likewise euery 20 leagues that you sayle to the Northward, you rayse, or the pole is higher aboue your Horizon one degree: but if you sayle vpon any other point from the Meridian to the eastward or westward, you must sayle a greater number of Leagues to rayse or depresse the pole one degree, and so consequently, more or lesse, according as your course is distant from the north or south towards the East or west, vpon any rombe or point whatsoeuer, where you are to note, that if you saile north or south from the place where you are, you keepe still one Meridian, differing onely in latitude, but not in longitude, and sayling east or west, you keepe still one paralell, differing onely in longitude and not in latitude: but if you sayle vpon any other point, as is aforesaid, betwixt the north & east, north and west, south and east, or south and west, then in sayling any distance you alter both longitude and latitude, more or lesse, according to the distance that you haue sayled, which being known, for one degrees difference eyther of longitude or latitude, may very easily bee knowne, for much more: and for one degrees difference of latitude and distance departed from the meridian, at the saide difference of latitude, vpon any of the said intermedian points, being 7, this little Table will to the vttermost of your desire instruct you.

In

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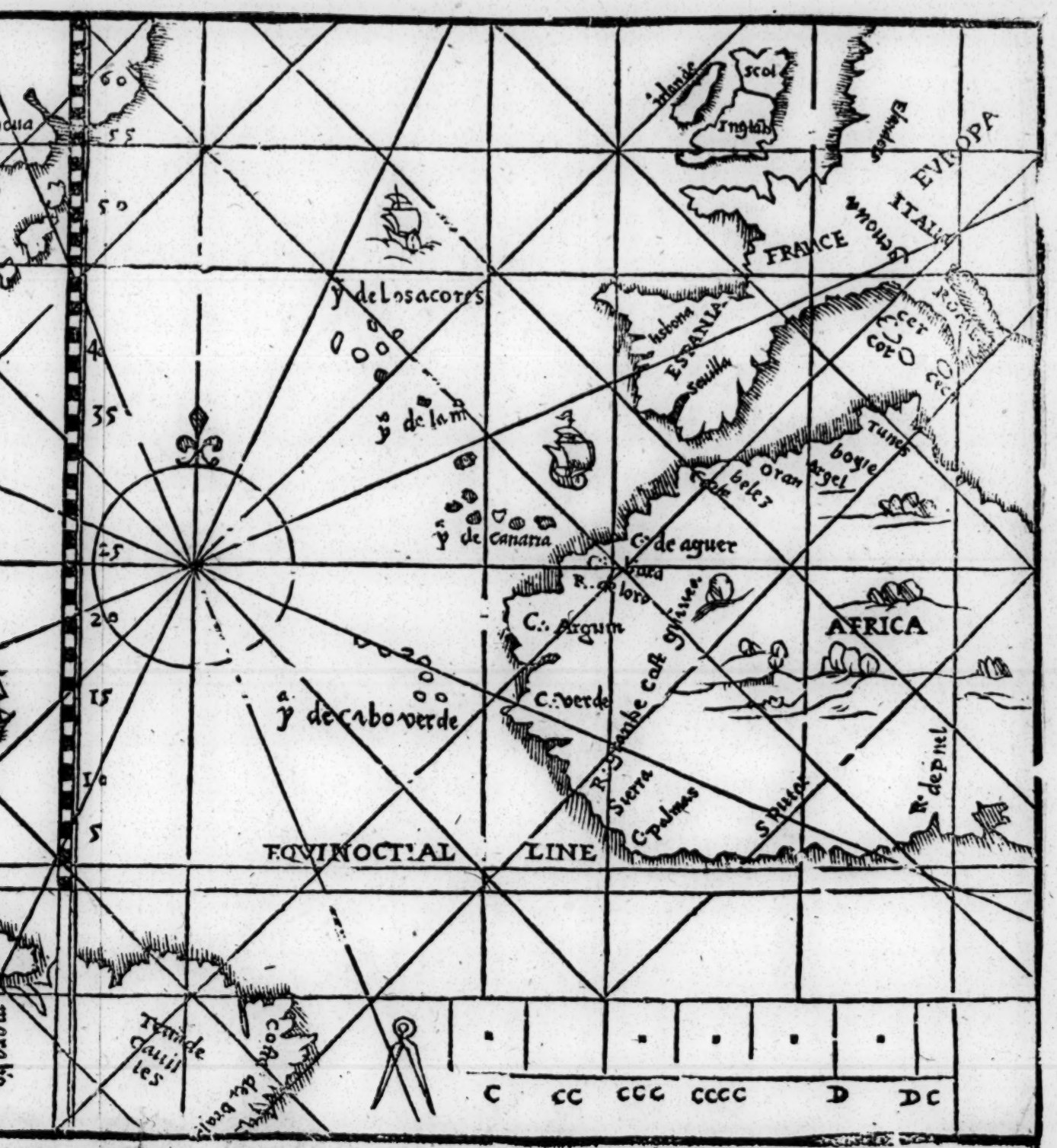

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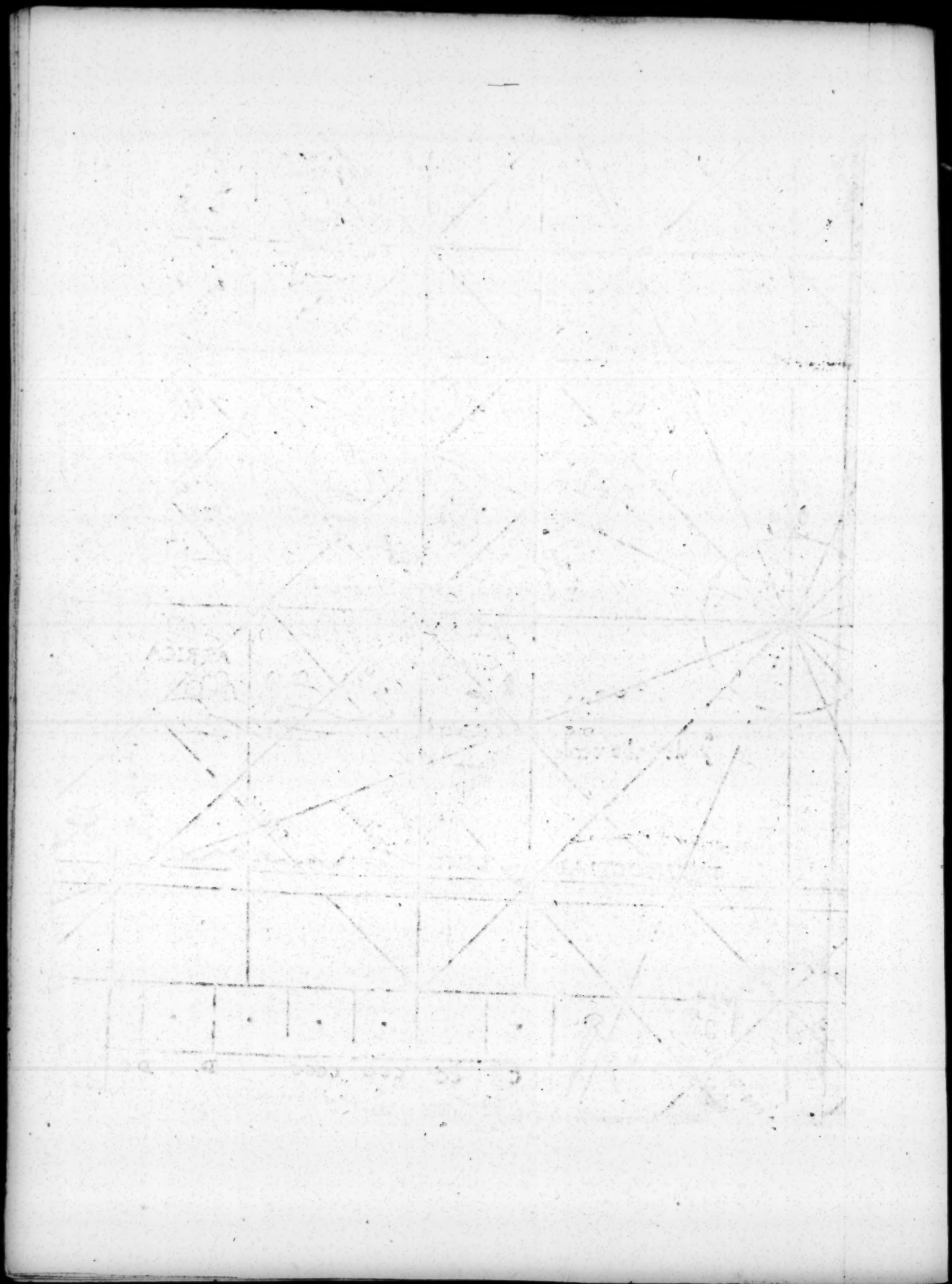


In sayling	To rayse or lay one degree,	Departed from the Meridian:
North or South.	20 Leagues,	0.0. Leagues,
N.b.E.S.b.W. N.b.W.S.b E.	20 Leagues and 1 mile,	4 Leagues.
N.N.E.S.S.W N.N.W.S.S.E.	21 Leagues, and 2 miles,	8 Leagues and one mile,
N.E.b N.S.W.b S N.W.b N.S.W.b S	24 Leagues,	13 Leagues and 1 mile.
N.E.S.W. N.E.S.E.	28 Leagues and one mile,	20 Leagues.
N.E.b E.S.W.b W N.W.b W.S.E.b E	26 Leagues,	30 Leagues,
E.N.E.W.S.W E.S.E.W.N.W	52 Leagues and a mile,	45 Leagues and a mile,
E.b N.W.b S. E.b S.W.b N.	102 Leagues and two miles,	101 Leagues,
East and West 20 Leagues makes a degree difference of Longitude, onely in the Equinoctial Circle.		

And now as I promised I will shew you how to reduce Spanish or Dutch Leagues into English leagues, and so likewise eyther of them into other, of all which at one time or other you may have occasion: And first you must know that 17 leagues and a halfe Spanish, or 15 leagues Dutch are equall unto 20 English leagues, so many of eyther of them being equall unto one degree of a greate Circle, as are peculiarly appropriated unto them, the manner of reducing them being as followeth, our English leagues are most facile and easie, being that they have such a correspondencie to the degrees and minutes of the Equinoctiall, euerie League valuing three English miles, and euerie mile one minute of the Equinoctiall, and therefore when you would reduce Spanish Leagues into English, multiplie

your Spanish leagues by 20. and diuide the totall by 17.½. the quotient shewes your desire, and for Dutch leagues, multiply by 20. and diuide by 15: for example, I would know how many English leagues is contained in 7 Spanish Leagues: first I multiplie 20 by 7. the totall is 140. which diuided by 17 ½. the quotient is 8. so I conclude that seuen Spanish Leagues are equall vnto eight English leagues.

Againe, if you would reduce 135. Dutch Leagues into English Leagues, multiply 135. by 20. and the totall 2700. deuided by 15. the quotient being 180. sheweth that there are so many English Leagues in 135. Dutch Leagues, and so may you reduce any number of leagues, out of any one forme into another.

CHAP. XIIII.

How to set or make a pricke in the Carde of Nauigation.

The Mariners call the pricking of a point in the Carde, to set and appoint in it, in what point or part of the sea, the ship is in Nauigation: for the performing whereof, it shall be requisite, that the Pilot know from what degree or how many degrees of the altitude of the Pole he departed and with what wind he sayleth: and when he desireth to know where he is, let him know the altitude of the Pole by some of the aforesaid rules. And if (taking the altitude) hee finde himselfe in the same degrees, where hee was when he departed, his Nauigation hath been from the East to the West, or else from west to East, and what hee hath gone, cannot be knowne but by the iudgement of a wise and expert man, according to the swiftnesse or goodnesse of his shippe, with consideration of the more or lesse vnder hee hath had, as wee haue said before in the first Chapter: but if hee finde himselfe in more or lesse degrees, let him take two payre of Compasses, and put the foote of one in the point or place where his ship was when he departed, and the other

in

in the line or winde by the which he sayleth, and likewise let him set the one point of the other Compasse in the graduation of the Carde, in that number of degrées that he findeth the altitude of the Pole, and the other point of the same compasse in the next line of East and West, and so with both the Compasses, one in the one hand, and the other in the other hand, let him goe ioyning them together, taking good héed, that the point of the Compas doe not swerue from the winde whereby he hath sayled, neyther the point of the other compasse from the line of East and West, where he set it.

And following those two Compasses by these two lines, vntill the points of the two Compasses ioyne (that is to meane, the point that was set in the place from whence he departed, and the other that was set in the degrées that were found) then where these two points doe ioyne, is the point where the shippe is. But (as we haue said in the first chapter) they must haue great respect to the winds and seas, and other thinges, which experience sheweth them, to know if they haue gone directly by that line, or if they haue fallen from it, and to what part, the which I remit to the iudgement of men of good experience. From thence forward they shall returne to keepe the same account, as when they departed from the hauen, especially, when they change their course.

CHAP. XV.

Of the making and vse of the Instrument generall, to know the howres and quantities of the day, and at what wind the Sunne riseth and falleth.

MAke a round plate with a ring or a handle aboue, as in the Astrolabie, drawing a line from the ring downward, passing through the center, and another line that may cut it in right angles through the Center: and this last line shall bee called the Horizon. Then shall you giue a Circle vppon the Center, leauing so much space betweene it and the edge of the Plate, that therein may bée written

written the numbers of the degrées: then also make another Circle somewhat more within, leauing likewise a space where the graduations may bee diuided. This done diuide one of the highest quadrants toward the left hand, into 90. parts, which shall bée called the degrées of latitude, beginning the number of them from the ring, and ending the same in the Horizon. Then make another rundel somwhat lesse then this, in such maner, that the Degrées and numbers of the greater, remaine vncouered. And diuide this lesse by two Diameters into foure equall partes, and at the one end of the one Diameter, leaue a point comming forth of the lesse Rundell, cut directly with the same Diameter by the one part, and this shall bée called the Inder or shewer. In this rundell, you shall make a Circle halfe a finger lesse then the Rundell. Then with a Compasse take twenty thrée degrées and a halfe from the Diameter, which signifieth the Equinoctiall, and where as end the twenty thrée degrées and a halfe, for euerie part make a right line from one point to another, so that this bée a line of forty seauen degrees, and as much more at the other end of the said Equinoctiall. Vpon euery one of these right lines, you shall make a halfe Circle, and diuide euery of them into fiue equall partes, which may aunswere to fiue Signes, and euery Signe into thrée partes, which may aunswere to the tenthes, or tenth partes of degrées, and if the Instrument bée great, you shall diuide euery Signe into fiue or more parts, so that you may make it perfect and precise. This done, from the pointes or pickes of the one halfe Circle, to the points of the other, draw certaine lines which shall be equidistant to the Equinoctiall. In the ends of these lines, betweene the lesse Circle, and the edge of the rundell, draw also certaine lines, which may reach vnto the beginnings and ends of the Signes, and in the toppe of the ends, or ouer the ends of these lines, make an Arke, so farre distant from the lesse Circle, as is the thicknesse of the edge of a peece of foure royalls of plate, and in the space that

is

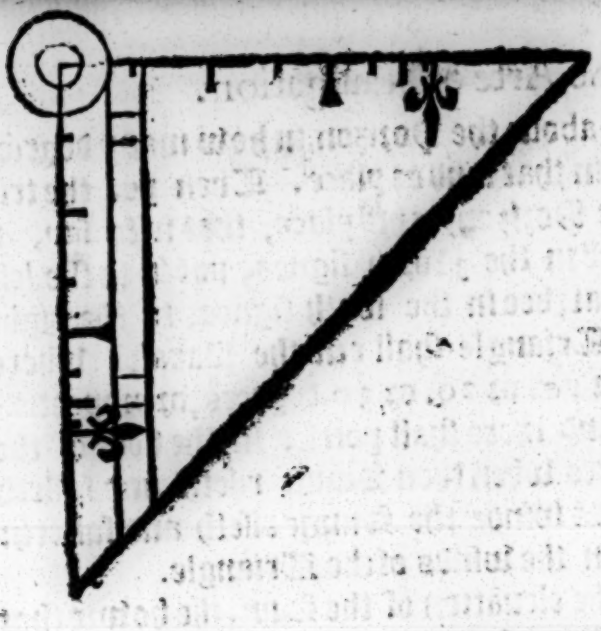
is left, graduate the Signes from ten to ten, or as the diuision shall be. The space that remaineth from thence to the edge of the rundell, you shall diuide by the halfe, and in it shal bee made twelue spaces, where you shall set the Signes with their names or Caracts orderly, so that Aries be next vnto the Equinoctiall, then Taurus toward the part of the Inder, then Gemini, and turning toward the Equinoctiall, Cancer, Leo, Virgo. Likewise on the other part of the Equinoctiall, Libra, Scorpio, Sagittarius, and turning to the Equinoctiall, Capricornus, Aquarius, Pisces. And thus hauing signed the Zodiacke, you shall also signe or marke the howres, in manner as followeth.

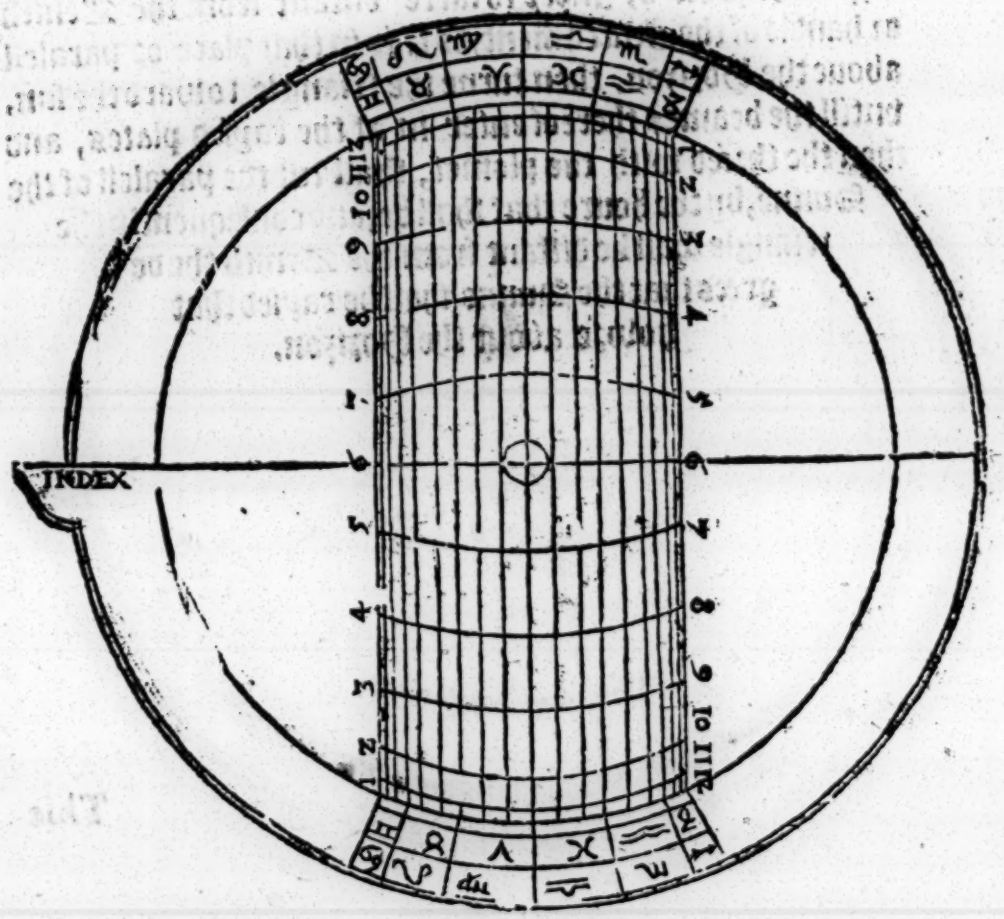
Diuide the lesse Circle of this rundell into foure equall parts, so that euery quarter may haue sixe parts. Reduce this Diuision to the Diameter, putting the ruler vpon the points, equally distant from the Horizon. And where it toucheth the Equinoctiall, make prickes or pointes, so that the Equinoctiall remaine diuided into twelue parts. Then vpon one of the Tropicks giue a circle, which may haue the same Tropicke for his Diameter. Diuide this Circle into twenty foure equall parts, and reduce these Diuisions to the Tropicke, as is done in the Equinoctiall, and from one Tropicke to another: then the Equinoctials, and the Tropickes being thus diuided with these prickes or points, you shall passe with a payre of Compasses, by euery point equally ordered from the Horizon, to the one and the other part, and these shall be called howres, writing in the ends of them their numbers, beginning the one part in one, and ending it in twelue. On the other part, beginne the one in the opposite part, and end in twelue. This done, these rundels shall be brought to their perfection. Moreouer, you shall make a Triangle with a right Angle, hauing two equal sides, that may make the right Angle. Euery of these sides, must be as long as the semidiameter of the greatest rundel: also, vpon and about the right Angle, you shall make a little

circle which shall haue the same Angle for his Center, and on the one side of this triangle, set two rayled plates, as in the Astrolaby, on the contrary side of these raised plates, must be a hole, so farre distant from the Center or Angle, as is the Semidiameter of the Circle of the lesse rundell. In this hole you must put a threede, hanging thereat a little weight or plommet, onely sufficient to holde the threed straight, so that it cause nothing of the rundels to turne, or the Instrument to decline. Furthermore, in a circle as bigge as the lesse of the lesse rundell, you shall diuide into 32. partes, the eight windes and halfe winds, and quarters of winds. And being thus reduced to their Diameters (as is done in the Equinoctiall) you shall translate them in the sides of the Triangle, in the which by the Center of his little Circle, and by the Center of the rundels, all the three peeces must be made fast with an Axis or a nayle, so that they may bee turned about close and very iust. Then put a ring in the handle of the Instrument, whereby it may hang, as in the Astrolaby, and so shall the Instrument be finished and brought to perfection.

This is the trace or draught of the Instrument.

To

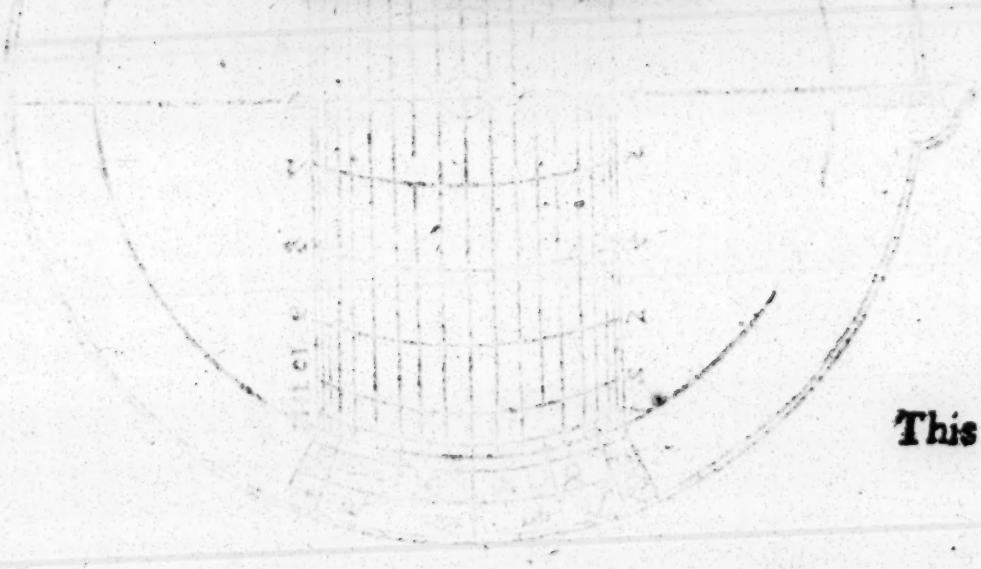




To know what howre the Sun riseth and falleth, by the Instrument following, you shall put the pole of the lesse rundel (which is the Index) to the left hand in the greatest rundel in

in so many degrees aboue the Horizon, in how many degrees the Pole is rayſed in that land or place. Then put the triangle (which is the Horizon) in his place, that is to say, if the Sunne shall bee in the North signes, put it to the left hand, and if it shall bee in the south signes, to the right hand, and then the Triangle shall cut the Paralell where the Sunne goeth in 10. or 20. or 30. degrees, or proportionally where it is, and there shall you see in the sides of the Zodiacke, the houres when then Sunne riseth and falleth And likewise at what winde the Sunne riseth and falleth: to vs, you shall see in the winds of the Triangle.

To know by the eleuation of the Sun, the howre that is, put the Pole or Inder so farre distant from the Zenith or handle of the Instrument, as it is in that place or paralell aboue the Horizon, then turne the triangle toward the sun, vntill the beames thereof enter in at the rayſed plates, and then the threed with the plomet, shall cut the paralell of the Sunne, by the houre that shall be, and consequently the triangle shall be distant from the Zenith the degrees that the Sunne shall be rayſed that howre aboue the Horizon.



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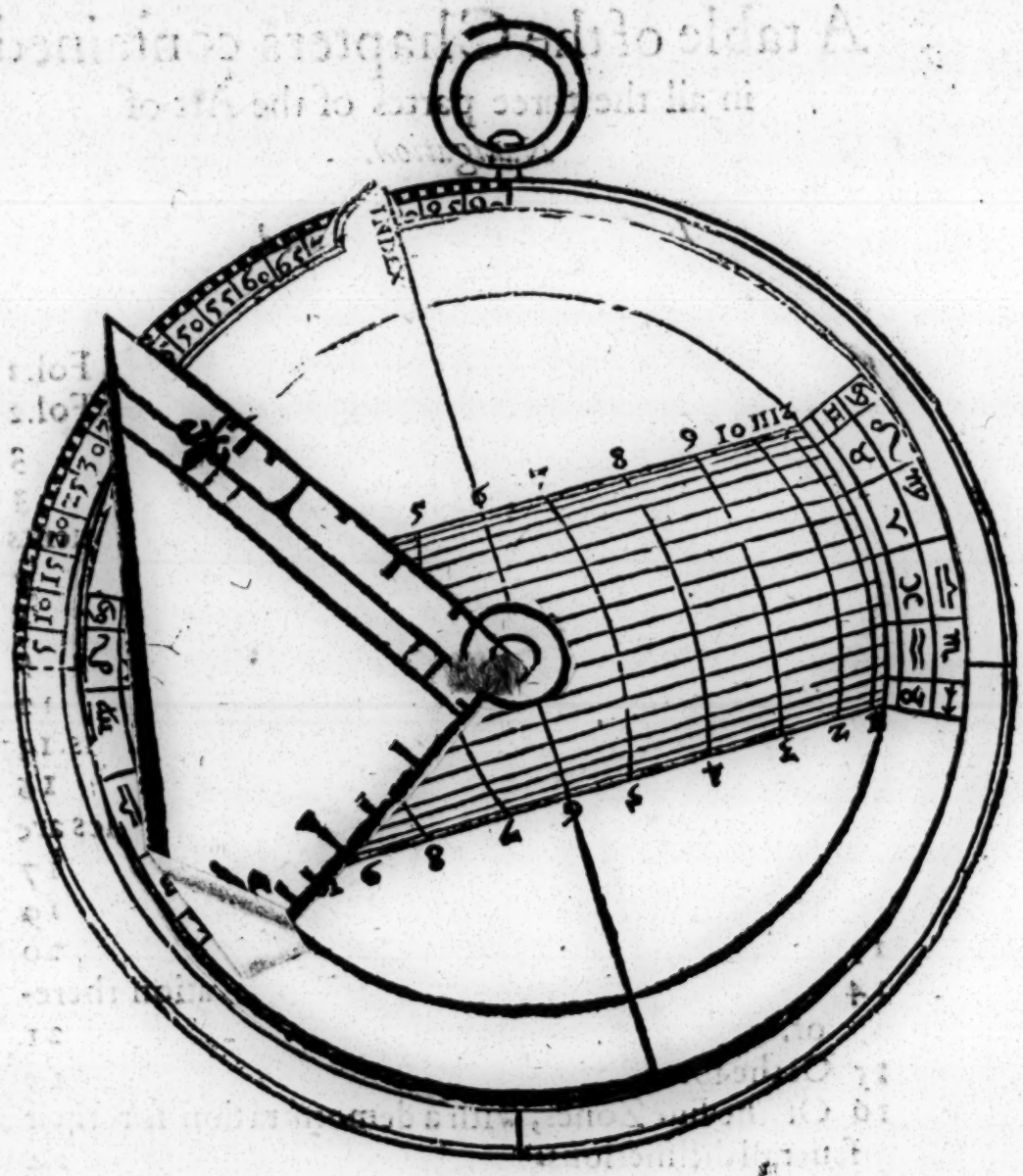

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